ELECTRICAL REVIEW

Vol. CXLVI 10th MARCH 1950 No. 3772

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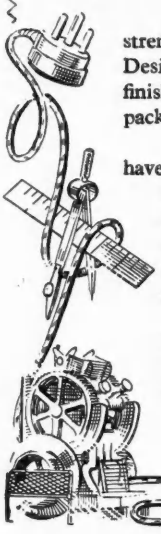

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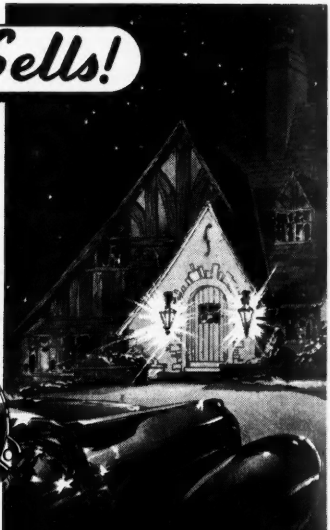

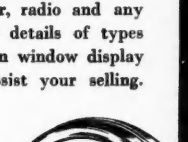

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ELECTRICAL REVIEW

Vol. CXLVI No. 3772 10TH MARCH, 1950

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Electricity's Handicaps

THE DANGER OF "MARKING TIME"

SHORTAGE of generating capacity, scarcity of materials and the need for capital economy have combined to discourage the extension of electrical services. There is, however, little wisdom in reducing activity below the enforced limits. If the connection of new consumers has to be slowed down there is still much scope for the cultivation of load among those already being served. Efficiency in the home is as desirable, if not so essential, as industrial efficiency and it is the duty of the electricity supply authorities to foster it.

Load-Shedding Risks

There is a poor future for them if they consider their sole duty to be to satisfy static demand until such time as more generating plant is available. They are naturally apprehensive of overloads but they cannot run the system on this basis; they must, of course, continue their endeavour to teach people to keep off the peaks but their main effort, and this is realized by most of the Electricity Boards, must be to fill in the "valleys." Cuts in supply have been comparatively insignificant in most areas (of course the mild winter must be acknowledged); the risks of cuts must be taken—but not too tragically.

The gas industry, which is not embarrassed by peak load troubles, continues its "promotion" policy. Some people in the electrical industry think that this is wrong, when retrenchment should be the first consideration, but the gas people realize that stagnation is death.

No doubt in some areas the existing mains are already potentially loaded to their capacity; that is if the diversity is poor. It is possible that too much weight may be given to possible overloads and in any event in a large number of districts where foresight has been exercised, the systems are still capable of carrying more.

But it is possible to add to the industry's reputation without adding to the load. Much of the equipment now in use is decrepit and out of date. Thousands of consumers, for instance, have had cookers since long before the war. Many of these are still serviceable but many more have really had their day.

Encouraging Replacement

The advertising by the Gas Boards is largely devoted to persuading their customers to replace their obsolescent cookers and there is a danger that their persuasion may cause a change-over among electricity consumers who do not know that they, too, can have their electric cookers replaced. At least one of the Electricity Boards—the Eastern Board—has campaigned in favour of old-cooker replacement; the others should do likewise—the cookers are available. This consideration applies not only to cookers but to many other household appliances. Moreover there is a good deal of scope for the renewal of installations, a matter in which electrical contractors could get

busy. Let the public see that the electrical industry is still alive; it will be fatal if they gain the impression that the gas industry is "burning to serve them" while the Electricity Boards seem to be somewhat reluctant to do so.

PURCHASE TAX REMOVAL

With a new House of Commons and with the next Budget in early prospect the Electrical Development Association has taken prompt action in the matter of purchase tax on domestic electrical appliances. Each Member of Parliament has been sent a copy of a memorandum setting forth a very strong case for the removal of the tax. Most of the arguments are familiar to our readers for we have put them forward consistently, but they may be new to some members of the House and are likely to impress those of all parties. The matter is entirely non-political; it is one of equity and common sense. Briefly, the memorandum points out that purchase tax on such necessities as these appliances does not prevent inflation for the money has to be spent. Nor does it really result in load relief or fuel economy, the two other arguments used in its favour.

FESTIVAL EXHIBITS

In this issue Mr. Gordon Russell, director of the Council of Industrial Design, comments on our leader of 24th February. He deprecates the suggestion that the Council is trying to dictate style in the production of electrical appliances and says that the Council's whole work is directed to fostering a distinctive British character in industrial design. The difficulty about the Festival of Britain display seems to be its restricted nature; this must militate against proper representation and must make the task of the selectors (however expert they may be) of choosing the "highest standard" a peculiarly trying one.

DELIVERY PERIODS

One of the clauses of the Convention for European Economic Co-operation provides that "the contracting parties shall promote with vigour the development of production, through efficient use of the resources at their command . . . and by the progressive modernization of equipment and techniques." To show the progress made in this direction, the O.E.E.C. publishes periodical figures relating to delivery dates. The latest volume purports to indicate the position at 15th December last, but there is a warning that "the situation is extremely fluid and that availabilities and delivery times are subject to rapid changes." Apart from this, the figures are not very definite. They relate to electrical equipment and many kinds of machinery and quote delivery periods for each participating country, but different types of plant are shown for different countries and the ranges of times are sometimes extremely wide. The statistics are consequently not a very helpful guide to the comparative productive abilities of the various countries.

MAGNETIC AMPLIFIERS

The basic operating principle of the magnetic amplifier is not new, but it is only in recent years, with the development of suitable magnetic core materials, that it has come to assume any real practical importance. Already it is being increasingly used in automatic control, particularly for field control in systems involving d.c. machines. Apart from its countless possible applications in the extension of electrical measuring techniques it is also likely to be used in servo-mechanisms in place of valve amplifiers, but a disadvantage here is that it has an inherently slow response. This can be improved by careful design, but probably means its preclusion as a radio-frequency amplifier. Nevertheless, with its robustness, high sensitivity, accuracy and capability of high outputs the magnetic amplifier obviously has great potentialities.

RURAL ELECTRICITY

Next week's issue of the *Electrical Review* will be devoted largely to rural electrification. It will include articles on various aspects of the subject, presenting the views of farmers, contractors and the electricity supply industry.

Power Flow Calculations

Some Elementary Considerations

By G. LYON,* B.Sc.(Eng.), A.M.I.E.E., Assoc. A.I.E.E.

It is often difficult to visualize the operation of a complicated power network and to predict the general effect of changes, particularly on reactive power flow. Much of the difficulty arises from attempting to consider everything at once and to think in terms of MVA and power factor. If the MVA is regarded as separate active and reactive components and the changes are considered individually it is easy to see what kind of effect will occur, but the subsequent numerical calculations may not be so simple.

If confusion is to be avoided certain conventions must be observed, the first of which concerns the polarities of voltage and current and the corresponding notation and symbols. Several more or less equally satisfactory methods are in use and the one employed in this article is shown in Fig. 1, where current flows and voltage rises in the direction of the appropriate arrows.

The second convention concerns reactive power. Active power is generated in a machine which converts mechanical to electrical energy and is consumed in devices which convert the electrical energy into mechanical or other forms, whereas reactive power is neither generated nor consumed, but only stored. The storage takes place in magnetic

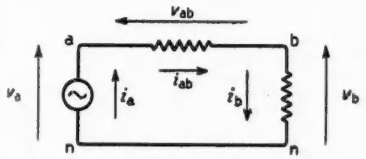

Fig. 1

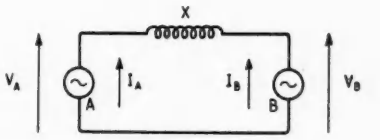

Fig. 2

(a) Fig. 3 (b)

or electrostatic fields, and energy alternates between apparatus having inductive and capacitive characteristics. This is inconvenient for considering power flows and a much better idea is gained of what effects can be expected if reactive power is said to be "generated" in capacitive-type apparatus, and "consumed" in inductive-type apparatus, To do this implies the adoption of the convention that lagging reactive power is counted positive (see *Electrical Review* 19th August, 1949, p. 333).

Most power systems are predominantly inductive so a good impression of their behaviour can be gained by considering pure (inductive) reactances. The effect of the resistance can be considered later.

Fig. 2 shows an elementary system in which two synchronous machines are connected by a reactance with no shunt circuits or loads and if the voltages V_A and V_B are equal and in phase, no current flows. Supposing, first, that V_A exceeds V_B in magnitude (Fig. 3a) then the current $I_{AB} = \frac{V_{AB}}{X}$ is in quadrature with both voltages, but must be

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considered as reversed in B since it flows in a direction considered negative in a generator (see Fig. 1). The reactive power received at B is $Q_B = -(V_B.I_{AB})$ that sent from A is $Q_A = V_A.I_{AB}$, and that "consumed" in the reactance is $V_{AB}.I_{AB} = I_{AB}^2X$. Note that no watts flow.

Suppose now that $V_A = V_B$ but that V_A leads V_B in phase (Fig. 3b) then I_{AB} is, as before, in quadrature with V_{AB}, but if the phase angle between V_A and V_B is small, I_{AB} is substantially in phase with both V_A and V_B. The active power received at B is equal to the active power sent from A, and approximately $P_A = V_A.I_{AB} = -P_B = (-V_B.I_{AB}')$. The negative signs indicate that B is motoring, the current in B being reversed as previously.

If I_A and I_B are divided into components in phase and in quadrature with their respective voltages V_A and V_B it is seen that whereas the in-phase components are of opposite sign in A and B, the quadrature components are relatively of the same sign, positive, in each, as they both lag the voltage (see Fig 4). This means that each machine "generates" the reactive power to supply half the system reactive "losses" I^2X.

In this treatment it can be seen that there are two steps:— (i) The current flow is determined from the difference voltage and the impedance and is independent of the absolute magnitude of the voltages. (ii) The powers at the machines are determined from the current and local voltages, and depend upon the absolute magnitude of these voltages. This illustrates the superposition of the results of a change $(V_A - V_B)$ in either Fig. 3a or Fig. 3b upon a network in equilibrium. The same method can be used to superimpose one change upon another, since the principle of superposition states that in a linear system, individual causes produce independent effects. Each change is considered as acting alone upon a dead network and the results are added to (or superposed upon) the original condition.

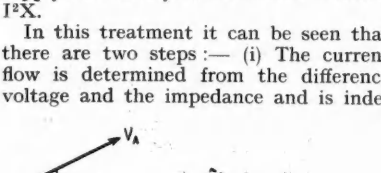


Fig.4

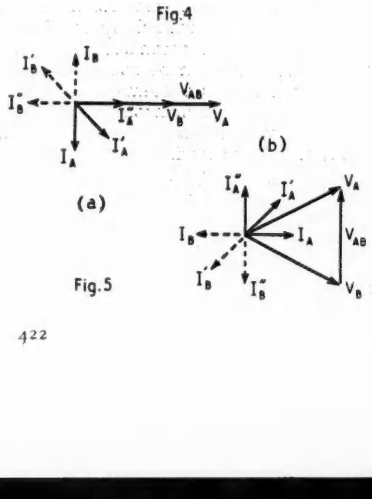


Fig.5

From the foregoing the effect of shunt reactive apparatus on a system is easily deduced. Since reactive power flows from points of higher to points of lower voltage, the injection of reactive power at any point must increase the voltage at that point to enable the reactive power to flow out into the system. Equally the abstraction of reactive power will lower voltage at that point. The effect of connecting shunt capacitors or reactors to a system is thus apparent. A synchronous condenser running over-excited acts as a capacitor, under-excited as a reactor. In the over-excited state, both generators and synchronous condensers generate reactive power, but since the latter are essentially motors they take active power from the system and have a leading power factor, whereas the generator power factor is lagging.

The presence of resistance in a system complicates matters considerably. Suppose that in Fig. 2 the reactance X is replaced by a complex impedance R + jX. If V_A exceeds V_B in magnitude, the vector diagrams of Fig. 5a can be drawn. If R is very small compared with X, then the currents I_A, I_B flow (as shown also in Fig. 3a). With a larger proportion of resistance, the currents become I_A', I_B' and it is seen that active as well as reactive power is sent from A to B. If R is very large compared with X, then the currents are I_A'' and I_B'', and only active power flows from A to B.

Suppose now that $V_A = V_B$ in magnitude but V_A leads V_B in phase angle (Fig. 5b). Again, if R is very small the currents are I_A', I_B'. With a larger pro-

portion of resistance, the currents become I_A I_B, and in addition to the active power transmission from A to B there is reactive power flow from B to A. If R is very large compared with X, there is only reactive power flow from B to A (for small angles between V_A and V_B).

From the preceding discussion it is possible to draw some conclusions upon power flows in general. In a purely inductive system, active power transfer is dependent almost entirely upon the phase angle differences between voltages, and reactive power transfer upon the magnitude differences: flow is from points of higher or leading voltage to points of lower or lagging voltage.

In a system of complex impedances, the effect of increasing proportional resistance is to make the active power flow increasingly dependent upon differences of voltage magnitude and the reactive power flow increasingly dependent upon differences of phase angle: the effects of voltage magnitude upon active and reactive flow are in the same direction, but the effects of phase angle differences upon these flows are in opposite directions. Active power flow is from points of higher or leading voltage to points of lower or lagging voltage: reactive power flow is from points of high or lagging voltage to points of lower or leading voltage.

Most practical h.v. systems can be expected to behave more or less in accordance with the pure reactance concept, but frequently, where the resistance is appreciable, the active power flow may be the reverse of normal if voltage differences are relatively large, or the reactive power flow may be the reverse of normal if the phase angle differences are relatively large.

It is usual to employ the symbols P and Q for real and reactive power respectively and it is helpful to construct vector diagrams using these quantities rather than currents. Fig. 6a shows the vector diagram for the circuit of Fig. 2 with V_A greater than V_B and leading in phase angle, and with a complex impedance R + jX. In Fig. 6b the current has been resolved into components in phase and in quadrature with V_B, corresponding to P and Q respectively at the receiving end. Fig. 6c is the same diagram inscribed with the symbols

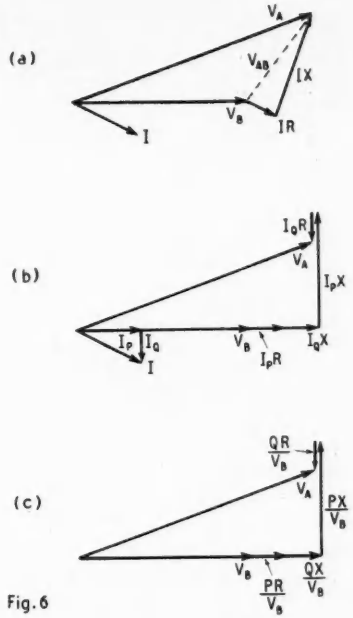


Fig. 6

derived from P and Q. It is instructive to draw similar diagrams for the other three combinations of magnitude and phase angle for V_A and V_B, and for various X/R ratios.

Before applying the conceptions discussed to illustrative examples it is desirable to refer to the per cent or per unit method which is often used in system calculations. It is not essential to use this method, but it simplifies the working. For example, the difficulty in understanding the interaction of networks operating at different voltages is reduced by expressing the voltages and impedances as percentages of nominal or "base" values at each point. Thus 145.2 kV and 12.1 kV both become 110 per cent of the nominal 132 kV and 11 kV of the networks in which they occur. Transformation ratios are reduced to the value by which they differ from nominal, e.g., 145.2/11 kV becomes 1.1/1.0, or + 10 per cent tap on the h.v. side.

To obtain full advantage from the percentage method it is necessary to select some other quantity in each circuit as the 100 per cent value. It may be

current or impedance, but usually it is most convenient to select a value of MVA which can be the "base" or 100 per cent power for the whole system. The "base" current and impedance corresponding to each base voltage then follow. If the three phase MVA is S, then :

$$I_{base} = \frac{S.10^6}{\sqrt{3}.V} \text{ amp } Z_{base} = \frac{V^2}{S.10^6} \text{ ohms. or}$$

$$I_{base} = \frac{S}{\sqrt{3}.KV} \text{ kiloamps } Z_{base} = \frac{KV^2}{S} \text{ ohms}$$

where V and kV are line-to-line values and Z and I are per phase.

The percentage method is very convenient, and is familiar from its use in short-circuit calculations, but can it be ambiguous when two quantities are multiplied or divided, e.g., 100 per cent current times 100 per cent impedance is 100 per cent voltage, not 10,000 per cent. The location of the decimal point is not always so obvious and ambiguity is avoided by the use of the per unit or fractional method, where the "base" quantity is regarded as unity instead of 100. Hence 1.0 p.u. current × 1.0 p.u. impedance = 1.0 p.u. voltage. The per unit method will be used in the rest of this article.

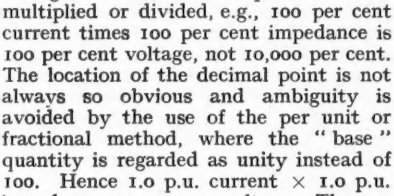


Fig.7

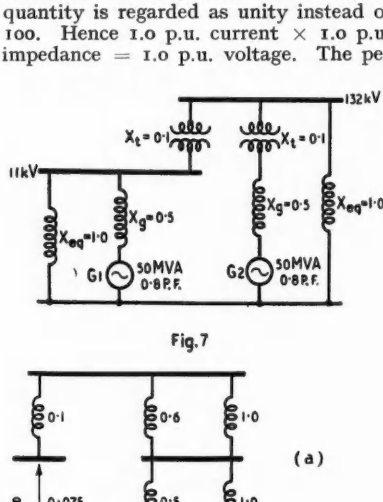


Fig. 8

Example 1.

A practical example using only reactances in the network for clarity is illustrated by Fig. 7, where a generating station has two generators running, one on the 11 kV and one on the 132 kV busbars. An equivalent reactance is assumed for the 132 kV and 11 kV systems connected to these busbars and that both machines have hand-controlled excitation set to give 11 kV and 132 kV respectively with the conditions specified. What effect upon the voltages and machine power factors has a 7.5 per cent change in tap on the interbus transformer, designed to raise the voltage on the 132kV side ?

The change to be made is the insertion of an in-phase voltage of 0.075 p.u. in series with the transformer, all reactances being per unit on 50 MVA (see Fig. 8 for equivalent circuit). The resultant current is 0.093 p.u., flowing up through the transformer, into G2 and its system, returning up through G1 and its system. As only reactances are used, this current is in quadrature with the voltage producing it and also with the busbar voltages. In practice, the equivalent system impedances would have to include resistance to enable the generators to supply active power.

The division of the circulating current gives 0.062 p.u. in G1 and −0.058 p.u. in G2. The voltage drop in the interbus transformer is 0.1 × 0.093 = 0.0093 p.u.; in G1 0.5 × 0.062 = 0.031 p.u.; and in G2 −0.6 × 0.058 = −0.035 p.u. Thus the l.v. bus voltage becomes 0.969 p.u. = 10.66 kV and the h.v. bus voltage 1.035 p.u. = 136.6 kV.

The reactive power increase in G1 is 0.969 × 0.062 = 0.06 p.u. = 3.0MVAr so that the new output is 40 MW 33.0 MVAr = 51.8 MVA at 0.775 p.f. The reactive power decrease in G2 is 1.035 × 0.058 p.u. = 0.06 p.u. = 3.0 MVAr so that the new output is 40 MW 27.0 MVAr = 48.2 MVA at 0.83 p.f.

If G1 had a voltage regulator set to maintain exactly 11 kV, the external 11 kV load could not change and all the circulating current would pass through the generator. If G2 also had a voltage regulator set to maintain 132 kV the load on this bus could not change either.

Consequently, tap changes on the interbus transformer could only circulate current in the generators without changing the bus voltages and all the tap voltage must be lost in the transformer reactance. In the latter example the generator outputs become : G1 40 MW 67.5 MVAr = 78.5 MVA 0.51 p.f. and G2 40 MW −7.5 MVAr = 40.7 MVA at 0.98 p.f. lead. This result illustrates the danger of using independent voltage regulators on closely tied generators; comparatively small changes in system conditions can cause heavy swings of reactive power which may even cause a generator to trip out or to lose synchronism.

Example 2.

In a further example a generating station supplies an 11 kV network which can be represented by feeds to two substations each taking a load of 25MW (see Fig. 9 where the reactances are per unit on 50 MVA). The 11 kV circuits from the station are overloaded and a 33 kV feeder is built to reinforce the supply to the outer end of the 11 kV system. What is the natural division of load between 11 kV and 33 kV and how much quadrature control is needed to give equal division ?

Since the values of the loads are specified, the natural division can be found by superposition. Thus the distribution of load B, 0.5 per unit on the base of 50 MVA, is as shown in Fig. 10a ; the distribution of load C is as shown in Fig. 10b; and the total natural division of load is as shown in Fig. 10c.

If the load flows AB and AC are to be equal, each must be 0.5 p.u., and a transfer of 0.179 must take place from AB to AC. Suppose that quadrature taps are fitted to the transformer at A. Then the equivalent circuit for boost is that of Fig. 11a. This can be simplified to Fig. 11b from which it is seen that the boost voltage required is $0.7 \times 0.179 = 0.125$ p.u. Hence the transformer must be set to give 12.5 per cent leading boost towards the 33 kV side, or an angular change of about 7 deg.

In applying the above simplified treatment to practical networks, certain difficulties are encountered. The most important is the complicated nature of the networks and of the effects which occur. Here it is necessary to distinguish between being able to see what sort of load flows may be expected, and being able to evaluate the quantities.

It has been shown that it is not difficult to understand the effect of a particular change in conditions, such as an increase of generator voltage. By superposing changes a general condition is obtained. First all generators

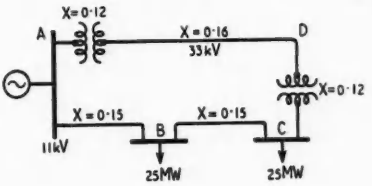
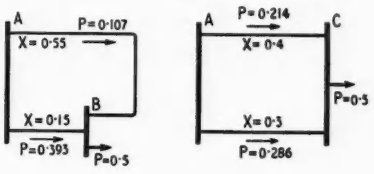
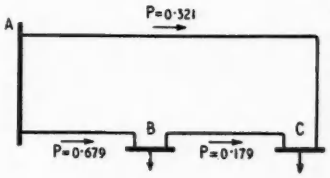


Fig.9

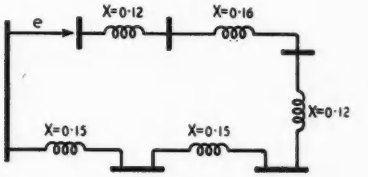


(a) (b)



(c)

Fig.10



(a)

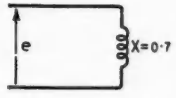


Fig. 11 (b)

are taken to have voltages equal and in phase and all transformers zero taps. The power flowing to the loads and other shunt circuits is then determined. Secondly, the voltage changes from the nominal starting condition are introduced one by one and thirdly, the power flow in generators and other defined circuits is corrected.

This is all very well in general terms, or if one is only considering a single change from a known condition. If several complete solutions are required for a complicated network, the work is tedious and may be economically impracticable. Several simplified methods of calculation are in common use. These depend upon various assumptions, which are sometimes justified but at other times lead to large errors. The commonest assumption, which was made in the examples, is to neglect resistance. Other frequently neglected factors are the interaction between active and reactive power and the effect of exciting voltage upon the boost introduced by transformers.

If attention is confined to MW flow and network reactances, the solution of quite complicated networks is not difficult. The most usual approach is by the application of the well-known " mesh current " method to " mesh megawatts." An arbitrary circulation in the various meshes of "a" "b" etc., in MW is assumed and the usual equations are derived from Kirchoff's second law. The voltage drops used are products of MW and reactance, and it is of interest to note that these are quadrature voltages, so that equating them to zero corresponds to making the total angular displacement in each mesh zero. A similar procedure can be followed to determine megavar distribution and impedances can sometimes be used instead of reactances.

Alternative Method

Another method of network evaluation has been set out recently by J. B. McPherson (*Electrical Review*, 23rd Dec., 1949, pp. 1191). The basis of this method is often used to simplify the equivalent circuit for individual distributors, but I have not previously seen a full development of network solution by this means.

Such methods have the disadvantage of entailing a good deal of arithmetic if the networks are complicated, particularly if, as is usual, several alternatives have to be considered. Direct current/resistance type calculating boards provide effective help if the assumptions required are justified, but are of no assistance for the calculations which are most tedious and prone to error, especially where complex quantities must be used.

Calculations by the various simplified methods yield solutions of power flow problems which are first approximations. Resistance, reactive power, and losses are often neglected and it may be difficult to deduce a reliable distribution of voltage. Such calculations are useful on single-voltage distribution systems, particularly where the p.f. of the loads does not vary widely. On the other hand, in systems having transformations between sections of different voltages, where the voltage distribution and reactive power control are important, the simplified calculations may lead to grave errors.

For such work the only satisfactory method of solution at present available is the a.c. network analyser, which is an adjustable scale-model network on which all normal system operations can be performed and measured. In the U.S.A. twenty a.c. network analysers are in full-time use, 60-70 per cent of the time on loading problems. In Britain a new analyser has recently been put into service (*Electrical Review*, 13th January, 1950) but previously only one analyser had been available for general use, that at Willesden owned by Associated Electrical Industries, Ltd. In 2½ years' operation this equipment has been used for extensive studies of networks in Britain and the Dominions as well as in Sweden, Spain and other foreign countries. The improved economy in system construction and operation which can be achieved with the aid of such analysers far outweighs the cost of using them.

The author thanks Associated Electrical Industries, Ltd., for permission to publish this article.

Niagara River Treaty

A TREATY between the United States and Canada signed last week authorizes any necessary measures to safeguard the Niagara Falls and gives a permanent legal basis to diversions of water from the Niagara River for hydro-electric purposes.

PERSONAL and SOCIAL

News of Men and Women of the Industry

As we reported last week, **Mr. P. J. Noel-Baker** has succeeded Mr. Hugh Gaitskell as Minister of Fuel and Power in the new Cabinet. **Mr. A. Robens** retains his former office of Parliamentary Secretary, Ministry of Fuel and Power, and other Junior Ministers include **Mr. T. F. Cook** (Parliamentary Under-Secretary of State, Colonial Office), and **Mr. C. R. Hobson** (Assistant Postmaster-General). In the list of electrical men returned to the new Parliament in our last issue we should have included **Sir William Y. Darling,** C.B.E., M.C. (Edinburgh, South), chairman of Bruce Peebles and Co., Ltd.

Mr. P. J. Noel-Baker

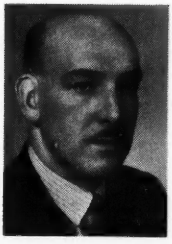
Mr. A. Robens

Mr. T. F. Cook

Mr. R. R. Stokes, upon his appointment as Minister of Works, has resigned his position as chairman and managing director of Ransomes & Rapier, Ltd., and is also leaving the boards of Cochran & Co., Annan, Ltd., and its associated company, Ruths Accumulators (Cochran), Ltd.

District managers have now been appointed by the South Western Electricity Board for the Bridgwater and Taunton Districts, Taunton and West Somerset Sub-Area. **Mr. H. G. B. Dickinson,** M.I.E.E., now district manager, Bridgwater, received his technical training at Faraday House before joining Johnson & Phillips. In 1936 he became distribution engineer to the South Somerset and District undertaking, and was later appointed deputy senior executive officer. When the undertaking vested in the Board, Mr. Dickinson became the Taunton Sub-Area commercial officer.

Mr. H. G. B. Dickinson



Mr. H. D. Weeks

The Taunton District manager is **Mr. H. D. Weeks,** B.Sc.(Eng.), A.M.I.E.E., formerly Sub-Area engineer, Torquay and West Devon Sub-Area. Mr. Weeks graduated from Bristol University, and after working as distribution transformer designer with Ferranti, Ltd., he joined the Weston-super-Mare Supply Co. In 1939 he was appointed to the Torquay Corporation undertaking, and later became distribution engineer.

Mr. W. C. P. Tapper, O.B.E., M.I.E.E., for many years borough electrical engineer and manager of the Stepney electricity undertaking, has been elected a Fellow of the Royal Astronomical Society.

Mr. E. R. A. Milne, A.M.I.E.E., A.I.Mech.E., M. Amer. I.E.E., has recently joined the staff of Fielden (Electronics), Ltd., in the capacity of sales manager, and will operate from their new works at Paston Road, Wythenshawe, Manchester. Mr. Milne was previously northern area technical representative for Everett Edgcumbe and Co., Ltd.

The staff of the **Liverpool Electric Cable Co., Ltd.,** held their annual dinner at the Exchange Hotel on 14th February, when Mr. W. J. Terry (managing director), Mr. G. E. Jewell (director) and Mr. F. W. Freeman (director of an associate company) travelled from London to attend the function. Mr. J. T. Frost, works manager, proposed the toast to the future of the com-

pany, and, in responding, Mr. Terry thanked the staff for their support over the past year.

The annual dinner and dance of the **Worcester Electric Club** was held recently at the Star Hotel, Worcester. The toast of the Club was proposed by Lt.-Gen. Sir Ronald M. Scobie. Mr. H. H. Smith, in reply, mentioned that the Club's membership was now more than 130, and he paid tribute to the work of Mr. C. H. Ponting, the president, and Mr. A. H. White, the secretary. Mr. Ponting proposed the toast of the guests, and Ald. W. S. Lewis, chairman of the Midlands Electricity Board, responded.

The dramatic section of the Victoria Works Athletic Club **(Johnson & Phillips, Ltd.)** presented "The Shining Hour" by Keith Winter, on 2nd and 3rd March. The play was produced by Mr. W. Prior. Among the audience were Mr. G. L. Wates, chairman of the company, Mr. W. Glass, joint managing director, and Mr. R. W. Reeves, a director.

Mr. M. A. Doggett has resigned from the board of the Sturtevant Engineering Co., Ltd., on account of advancing years, and he has been succeeded as sales director by **Mr. A. B. Davies.** Mr. Doggett has been with the company for forty-nine years.

OBITUARY

Mr. J. G. Statter.—The death occurred on 28th February, at the age of 87, of Mr. John Grice Statter, M.Inst.C.E., M.I.E.E., chairman and joint managing director of J. G. Statter and Co., Ltd. Mr. Statter was educated at Sandringham School, Southport, and at the University at Leeds (then called the Yorkshire College). He served as a pupil of Col. Crompton at Chelmsford, and about 1899 commenced the manufacture of switchgear in partnership with the late Mr. L. S. Brunton. In the early 'nineties he commenced the business of Statter and Co., which was merged with Switchgear and Cowans, Ltd., in 1912; thereafter he started the present business of J. G. Statter and Co., Ltd.

The late Mr. J. G. Statter

We reproduce a portrait of Mr. Statter taken some years ago.

Mr. T. Birkett.—The death occurred on 5th March, at the age of seventy-eight at his home in Birmingham, of Mr. T. Birkett, who after many years with Simplex Electric Co. joined the Midland Electric Manufacturing Co., Ltd., as sales manager in 1920. He was appointed general manager in 1926 and later to a seat on the board. He retired in 1937 on reaching the age of sixty-five. Mr. Birkett was president of the Birmingham Electric Club in 1927.

Mr. G. B. Melton.—The death is announced of Mr. George Baratclough Melton, A.M.I.E.E., M.I.F., generation engineer (construction) in the B.E.A. Yorkshire Division, which occurred on 6th March at the age of fifty-nine. Mr. Melton received his technical training with Hathorn Davey & Co., Leeds, and from 1912 to 1914 was technical assistant with the Yorkshire Electric Power Co. After five years as plant engineer with the Gramophone Co., Hayes, he returned to the Y.E.P. Co. in 1919 as station construction engineer, being appointed chief engineer in 1942.

WILLS

Mr. L. G. J. Bratt, founder of Bratt Colbran, Ltd., who died on 19th October last, left £18,723 gross (£13,724 net).

Mr. A. P. Pope, late contract manager to the Southern Works of United Telephone Cables, Ltd., who died on 9th October last, left £5,474 gross (£5,399 net).

Birmingham Electric Club

THE strength and prosperity of the Birmingham Electric Club are apparent from the fact that while over four hundred members and guests were present at last Friday's annual dinner at the Grand Hotel, Birmingham, almost an equal number of applications for tickets had to be refused on account of lack of seating accommodation.

Proposing the health of the Club, the Lord Mayor of Birmingham, Alderman Hubert Humphreys, J.P., commented on the remarkable development of the electrical industry and congratulated the Club on its foresight and success. In reply the president of the Club, Mr. J. Ashmore, mentioned that the Club, which was the oldest and largest of its kind in the world, catered for every phase of the industry. It was hoped to donate a scholarship to the Technical College.

The toast of the guests was proposed by Mr. A. T. Haywood, vice-president of the Club. In reply Mr. J. W. Donovan, chairman of the South Midland Centre of the Institution of Electrical Engineers, and himself a past president of the Club, said that the electrical industry in Birmingham owed a great deal to the marriage between the I.E.E. and the Club.

E.D.A. AND PURCHASE TAX

A PRESS "pre-view" of the Electrical Development Association's Ideal Home Exhibition display was held last week at the Institution of Electrical Engineers. It comprised a model of the stand and examples of some of the appliances which it was proposed to show. Mr. Norman Phillips, E.D.A. exhibition organizer, explained the design and purpose of the display (described elsewhere in this issue) in an amusing and interesting way.

In introducing Mr. Phillips, Mr. V. W. Dale, general manager and secretary of E.D.A., made particular reference to the burden of purchase tax borne by many electrical appliances. The strong case for the removal of the tax on electrical household equipment is set out in a memorandum, a copy of which has been sent to each of the new Members of Parliament.

The memorandum, as explained by Mr. Dale in an admirable exposition of the subject, points out that purchase tax was imposed originally as a wartime safeguard against inflation. Its continuance in peacetime might be justifiable if it were confined to luxury goods, but there was no case for its retention on essential household articles. That view had been partly accepted by the Government in 1945 and 1946 when first cooking equipment and refrigerators and then kettles were freed from the tax. In 1947, for a time, the tax on all domestic electrical appliances was raised to 66⅔ per cent, but after representations by E.D.A., backed by local authorities, there was a reversion to the former rates generally; the tax on water heaters and space heaters remained at 66⅔ per cent, however, and was later raised to 100 per cent. In January this year the tax on storage water heaters was reduced to 66⅔ per cent. In 1948 a tax of 33⅓ per cent was placed on refrigerators and still remains.

The memorandum deals with the common domestic appliances one by one and electric lighting to show how essential they are and how, on balance, they are economizers of fuel. It is emphasized that the bulk of Britain's electricity is generated from coal which is largely unusable for any other purpose.

The serious effect of the tax on employment in the electrical appliance industry is mentioned, particularly in the case of water heaters; it is stated that since the reimposition of the tax the number of people employed in water-heater production has fallen by about 57 per cent. This means training new staff and operatives when the "frozen" demand for water heaters is released.

In his remarks, Mr. Dale thought that too much had been made of the danger of power cuts during the peak hours, pointing out how infrequently these had occurred in the experience of most individual consumers. He thought that if people could be persuaded not to use their electric fires during peak periods, except in illness or emergency, the problem would be virtually solved.

His conclusion was that unless better reasons for the tax on domestic electrical appliances could be put forward it should be removed at the earliest possible moment.

EASTERN CONSULTATIVE COUNCIL

THE question of admitting the Press to meetings of local committees was again raised when the Eastern Electricity Consultative Council met at the Charing Cross Hotel, London, last Friday. It was agreed to recommend to the Minister of Fuel and Power that the scheme should be varied to allow this. Alderman W. J. Bennett, chairman, said it was appreciated that a common scheme was being devised for the nationalized services; that was why the arrangements were provisional. The Council was of the opinion that it would be advantageous to open the meteings to the Press.

Reporting on the work of the Council in the twelve months since it first met, the chairman said that 82 appreciations had been received, rather more than half from persons requesting an urgent supply—mainly in rural areas. These, as Mr. M. D. Perrins pointed out, were additional to matters taken up directly by members with the Board's District offices.

The Council's assistance in one such case was the subject of a letter of thanks from Mrs. Leah Manning, who said that she was finding the Council very helpful. In this particular instance, because of the special circumstances, the Board had agreed to give a restricted supply to a blind ex-Serviceman poultry farmer, although the mains had reached the limit for maintaining satisfactory voltage.

In the morning the General Purposes Committee was addressed by the chairman of the Board, Mr. C. T. Melling, on the Board's work during the year, and the chief engineer, Mr. G. N. Green, presented a financial and engineering statement.

VIEWS on the NEWS

By REFLECTOR

ELECTRICITY is so often accused of detracting from amenities that it is very heartening to hear of any instance in which it actually contributes to them. Such is the case at Brighton, where the Corporation has accepted an offer from the B.E.A. to dump 1½ million cubic yards of pulverized-fuel ash from Southwick power station to level up the site of a new public park and sports ground. The alternative would have been to carve chalk from the sides of the valley in which the park is to be situated; this would have been costly and would have marred the hillsides. The scheme has the added virtue of solving an ash-dumping problem for the B.E.A. and so everyone is happy.

★ ★ ★

It is reported that when two tenant farmers in the Lanark district entered a byre last week-end their hair stood on end and their dog leapt back through the door. The byre is said to have been "alive with electricity" even after the switch had been put off. Allowing for possible exaggeration, there must have been something fundamentally wrong with the installation for four cows were killed. According to the *Daily Mail* the electrical contractors concerned said that the trouble might have been the sandy soil, which dried easily and did not give a good earth. They concluded rather strangely: "But what happened will always remain a mystery."

★ ★ ★

Opponents (and many advocates) of State ownership are agreed that if nationalization is imposed it is best done by means of a public corporation and not by a Government Department. Justification of this attitude was provided last week by Mr. R. H. S. Crossman, M.P., who complained of the difficulty experienced by the Minister of Fuel and Power to get "the Gas Board, the Electricity Board and the Coal Board to carry out the policy of the Government." I hope that the Boards will remain strong enough to run their industries in the best interests of the public rather than allow themselves to become mere instruments of Government policy. Mr. Crossman (as reported in *The Times*) said that these gigantic public corporations had been taken out of politics and there was no public control. I think that, given freedom of choice, the public itself (apart from the Government) will exercise quite a considerable amount of control.

★ ★ ★

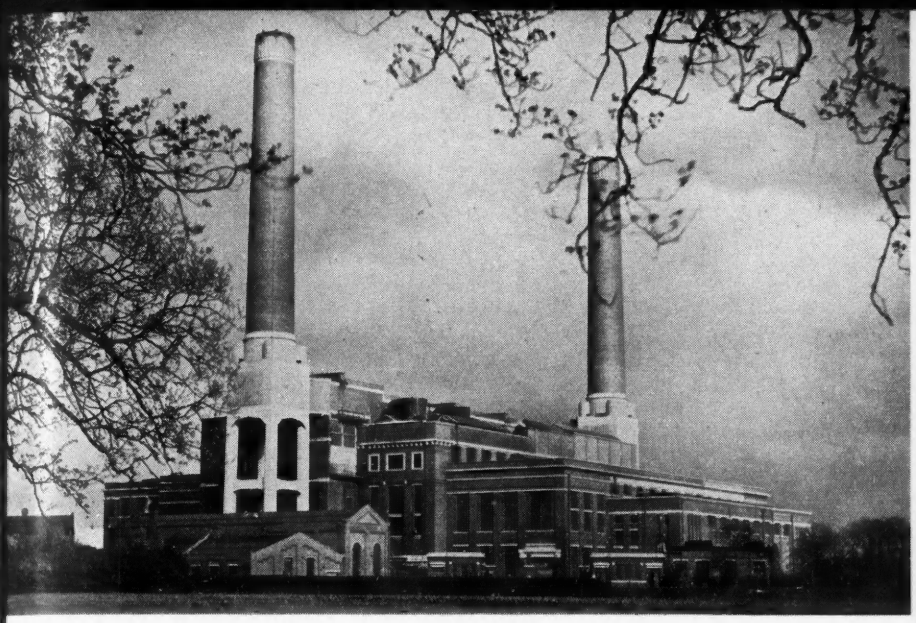
I see from the *Edison Electric Bulletin* that the San Diego (California) Gas & Electric Co. recently ran a contest in which children between the ages of 8 and 15 were encouraged by the offer of prizes to secure the sale of lamps. In just over a month contestants were credited with a sale of 7 million watts. This was very enterprising of the company, but the official who presented the prizes seems to me to have reached the height of hyperbole in describing the entrants as "representing the cream of American youth, the youngsters who are growing up with an understanding of the value of the American way of life."

★ ★ ★

Extract from the "Gridiron" (magazine of the Merseyside and North Wales Division, B.E.A.): ". . . a flashover damaged a post-type insulator and an O.C.B. bushing, but no supplies were lost. This was probably due to salt deposits carried over during gales." *Cum grano salis?*

★ ★ ★

Mr. Maurice Webb, the new Minister of Food, is reported to have said that he would try not to use the word "calories" but would talk about "food." May I suggest to the new Minister of Fuel and Power that he should be more concerned with "calories" than just "coal"?



National Supply Survey

ELECTRICAL ASSESSMENT OF THE FOURTEEN AREAS

10
NORTH WESTERN AREA

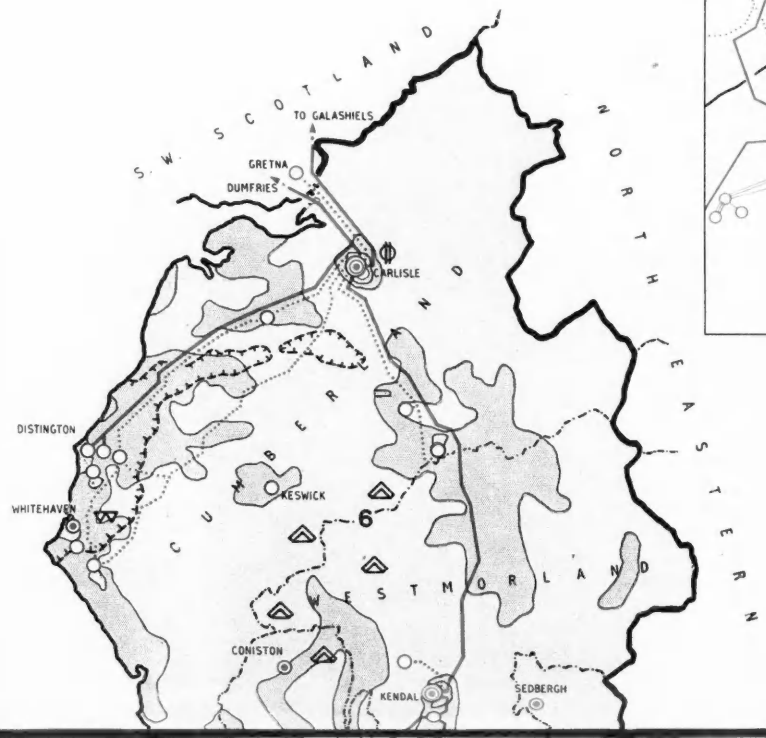
FROM the earliest times depicted by English history the North West has produced poets who have written with affectionate insight of the scenic panorama of the Area, and their verse and similar records afford some of the best pointers to the culture, history, character and all that goes to make the life of what has now become one of the fourteen new electricity supply areas under the Electricity Act of 1947.

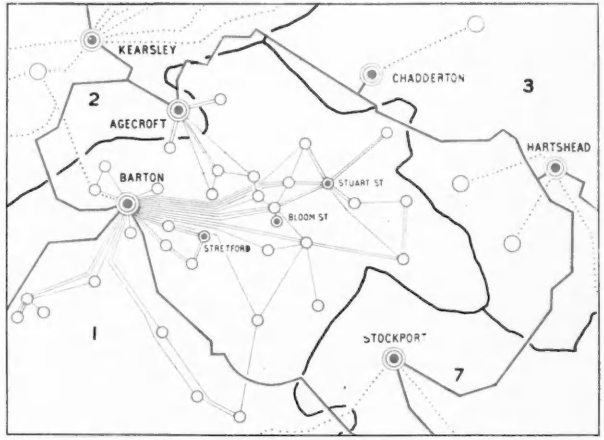
But we cannot talk of scenic panorama in relation to the more limited area in and around Manchester, which embraces one of the country's most concentrated industrialized territories in a 30-mile, roughly east to west, belt which is about one-fifth the total length of the official Area. This smaller area also constitutes the world's most important cotton manufacturing centre.

One result of the above glimpses of two extremes is that whereas in the greater northern part one can read the past more clearly in the life of the present, in the south on which the industrial revolution has borne so heavily the cultural background has tended to become blurred by the later furious activity.

It is perhaps too little appreciated to-day that the importance of Manchester as a great inland port still rests on that great national achievement, the Manchester Ship Canal.

Barton Power Station, above, with an effective generating capacity of 144 MW, is fourth in size in the Area





This inset shows in clearer detail the main transmission in Manchester and surrounding districts

For the first time in these National Supply Survey articles we have adopted as a characterizing background to the electrical assessment map, which has been specially prepared by the *Electrical Review*, load density based on a map specially prepared by the North Western Electricity Board

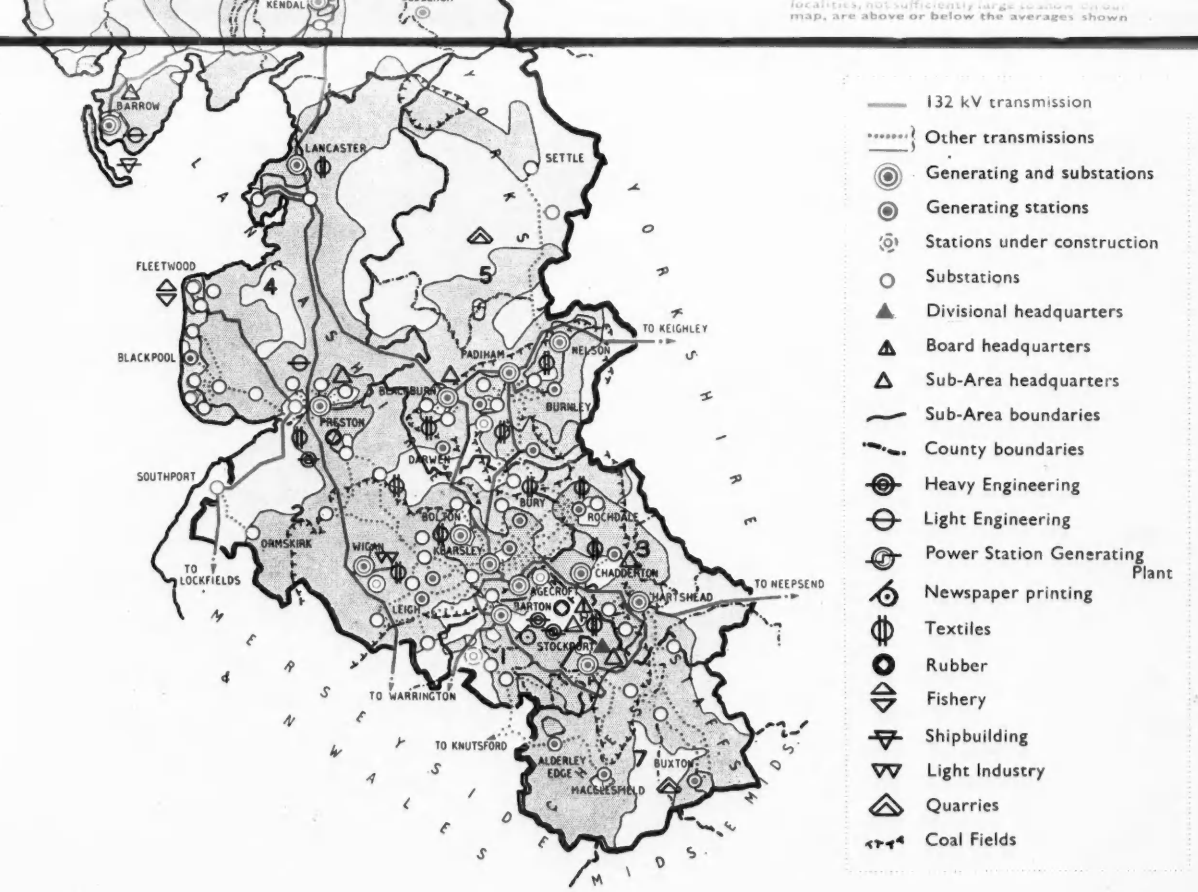
Load Density (kW per sq. km.):

White areas	**2,500—10,000 kW.**
Grey areas	**500—2,500 kW.**
Blue areas	**1—500 kW.**
Red areas	**less than 1 kW.**

Within the above load density areas small localities, not sufficiently large to show on the map, are above or below the averages shown

132 kV transmission

localities, not sufficiently large to show on our map, are above or below the averages shown



- 132 kV transmission
- Other transmissions
- Generating and substations
- Generating stations
- Stations under construction
- Substations
- Divisional headquarters
- Board headquarters
- Sub-Area headquarters
- Sub-Area boundaries
- County boundaries
- Heavy Engineering
- Light Engineering
- Power Station Generating Plant
- Newspaper printing
- Textiles
- Rubber
- Fishery
- Shipbuilding
- Light Industry
- Quarries
- Coal Fields

Some Arthurian legends associated with the smaller area we have referred to have detailed accounts of hunts, and to widen our field perhaps we can regard the Area as a whole as one of culture and history, a playground of great splendour and a literary home.

When the foundations of the present Round House on Belle Island on Lake Windermere were cut in 1777 a quantity of Roman pottery and tiles and some armour were found. The first occupation of the Island reliably recorded was by Walter de Lyndesay, in the thirteenth century. He was one of Scotland's ambassadors to Henry III. Another island which contributes to the Area's culture is St. Herbert's Isle on Derwent Water. Bede said the two friends St. Cuthbert and St. Herbert prayed to die on their respective islands Lindisfarne (North Eastern Area) and St. Herbert's simultaneously, and that their prayer was granted.

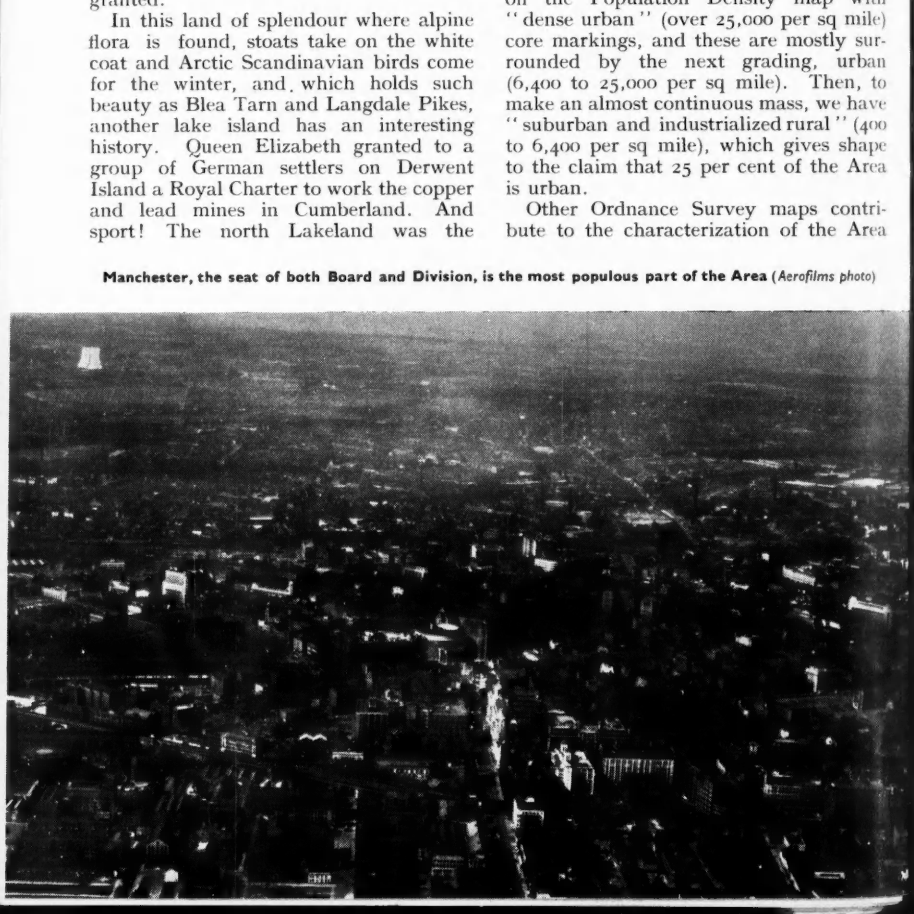
In this land of splendour where alpine flora is found, stoats take on the white coat and Arctic Scandinavian birds come for the winter, and which holds such beauty as Blea Tarn and Langdale Pikes, another lake island has an interesting history. Queen Elizabeth granted to a group of German settlers on Derwent Island a Royal Charter to work the copper and lead mines in Cumberland. And sport! The north Lakeland was the hunting ground of John Peel, and Wordsworth was often lured from his work to watch the world-famous wrestling of the Fells.

From the Ordnance Survey Urban Areas map it is evident that, except for London, the south of the North Western Area represents the most extensive urban area in the country. Around Manchester and Salford, with a population about the million mark, there are clusters of smaller towns averaging about 50,000 in their populations and including such well-known names as Wigan, Leigh, Eccles, Stretford, Sale, Stockport, Hyde, Stalybridge, Mossley, Oldham, Rochdale, Heywood, Bury, Radcliffe and Bolton. Preston, Blackburn and Burnley may be said to be the larger towns on the northern fringe of this dense urban area, while on the coast there are Blackpool, Fleetwood, Morecambe and Barrow-in-Furness.

Many of these towns are represented on the Population Density map with "dense urban" (over 25,000 per sq mile) core markings, and these are mostly surrounded by the next grading, urban (6,400 to 25,000 per sq mile). Then, to make an almost continuous mass, we have "suburban and industrialized rural" (400 to 6,400 per sq mile), which gives shape to the claim that 25 per cent of the Area is urban.

Other Ordnance Survey maps contribute to the characterization of the Area

Manchester, the seat of both Board and Division, is the most populous part of the Area (*Aerofilms photo*)



in their various and important ways. For instance, the vegetation map shows a coastal belt of argostic-ryegrass vegetation from North Cheshire up to Lancaster, where it gives way to mainly argostic. Further north we have a great area of Heather Fell on the Cumbrians, with lower grade argostic on the lower slopes. On the Land Classification and Land Utilization maps we see this vegetation picture represented as great cattle feeding and rearing pasture lands.

The Types of Farming map depicts high-class market gardening in the south-west, arable and mixed farming south of Manchester, and dairy farming around Macclesfield. This dairy farming area extends from North Cheshire around the east and north of Manchester and then on south westwards where it opens out west and east as a belt stretching between and beyond Preston and Blackburn. Farther north we pass through a livestock farming area as we approach the Cumbrians, and finally reach the north mixed arable farming land.

The Coal and Iron map shows the Lancashire coalfield in the south with an area of about 900 sq miles and with its eastern boundary almost following that of the Area from about Colne in the north to Macclesfield in the south. Most of the active pits are due west of Manchester, almost in line formation to Ashton-in-Makerfield, and most of them are of the largest O.S. grading, i.e., over 1,000 men employed.

There are a few hæmatite 52-55 per cent iron ore workings in the Barrow-in-Furness region and again on the Cumberland Coast near Egremont. Following these references to the Coal and Iron map we expect indications of sizeable iron blast and open-hearth and electric steel furnaces on the Iron and Steel map, but there are surprisingly few furnaces on the great coalfield in the south of the Area.

Following such a general description of the Area it is well to define it closely in physical and geographical terms before embarking on the direct electrical assessment. With a total coverage of 4,831 square miles, 967 square miles of which represents urban districts, the Area embraces the whole of the counties of Cumberland and Westmorland, practically the whole of Lancashire, the exception being the south-west or Merseyside

The home of Ruskin, Brantwood, on the shores of Lake Coniston, is a reminder of the North Western Area's literary associations

corner, that part of Yorkshire which projects westwards from the main line of the Pennine Chain, the north-east corner of Cheshire which embraces Macclesfield, and the north-west corner of Derbyshire where the Area boundary just touches the Peak. The Area can boast of England's highest mountain, Scafell Pike in Cumberland (3,210ft), and of the country's longest lake, Windermere (10 miles). The Rivers Eden, Lune, Ribble, Mersey and Irwell add to the importance and activity of the Area, and so particularly do the ports of Manchester, Preston, Fleetwood, Heysham, Barrow, Whitehaven and Workington.

London apart, the North Western Area has easily the greatest generating capacity of any of the areas, with 1,566 MW effective capacity. This gives the Midlands Area a fairly close second with 1,252 MW effective capacity and the Yorkshire Area a closer third with 1,226 MW effective capacity. We present the accom-

panying schedule of the 36 generating stations operated by the North Western Division as a ready means of obtaining a picture of the generating position in the Area. Six stations above the 100 MW mark—Barton (Manchester) 161.5 MW, Bolton 107.5 MW, Hartshead 131.75 MW, Kearsley 272.07 MW, Ribble 181.1 MW, and Stuart Street (Manchester) 179.75 MW—have a collective plant capacity of considerably more than half the total for the Area.

About half the stations (19) have plant capacities above 20 MW, representing about 93.7 per cent of the total plant capacity in the Area. The largest station, Kearsley, was, in the days of coal selectivity before the war, the subject of pride for its high thermal efficiency and availability.

During the year 1948-49 5,509.1 million kWh was generated by the stations scheduled, and in the same period 460.8 million kWh was exported and 209.8 million imported. Thus, 5,258.1 million kWh was consumed and "lost" in the Area during the same period for which the simultaneous m.d. on all supply points on 31st January was 1,250 MW.

The following new power stations are now being constructed in the Area: Westwood (Wigan) which will have an ultimate capacity of 120 MW and is expected to be started up in 1950 with an initial capacity of 60 MW; Carrington (Manchester) which is being designed for a final capacity of 240 MW and is likely to be in commission in 1952 with 60 MW of plant; Huncoat (Accrington) which is to have an ultimate capacity of 120 MW and looks like being started up in 1951 with an initial capacity of 60 MW; and Agecroft (Salford) which will have an ultimate capacity of 210 MW and is expected to be first commissioned in 1950 with an initial capacity of 105 MW. In

GENERATING STATIONS OPERATED BY THE NORTH WESTERN DIVISION

Station	Previous Owners	Type of Station	Installed Plant Capacity Generation—MW	Effective Plant Capacity—MW	Method of Operation Shifts in 24 Hours
Accrington ...	Accrington Corp.	Steam	21.25	14	2
Agecroft ...	Salford Corp.	Steam	58.1	46	2
Alderley Edge	Alderley Edge & Wilmslow E.B. ...	Oil	0.5	0.4	1
Barrow ...	Barrow-in-Furness Corp.	Steam	24.05	20	2
Barton ...	Manchester Corp.	Steam	161.5	144	3
Blackburn ...	Blackburn Corp.	Steam	70.0	67	3
Blackpool ...	Blackpool Corp.	Steam	12.5	7	1
Bloom Street	Manchester Corp.	Steam	5.0	3	1
Bolton ...	Bolton Corp.	Steam	107.5	102	2
Burnley ...	Burnley Corp.	Steam	7.32	6	1
Bury	Bury Corp.	Steam	26.0	23	2
Buxton ...	Buxton Corp.	Oil	1.15	0.5	1
Carlisle ...	Carlisle Corp.	Steam	86.9	78	3
Chadderton ...	Oldham Corp.	Steam	41.25	35	2
Coniston ...	Barrow-in-Furness Corp.	Hydro	0.3	0.3	Normally unattended
Darwen ...	Darwen Corp.	Steam	2.35	1	1
Greenhill ...	Oldham Corp.	Steam	26.4	18	2
Hartshead ...	Stalybridge, Hyde, Mossley & Dukinfield Trans. & E.B.	Steam	131.75	119	3
Kearsley ...	Lancashire E.P.C.	Steam	272.07	258	3
Kendal ...	Kendal Corp.	Oil	0.8	0.7	1
Lancaster ...	Lancaster Corp.	Steam	52.45	49	3
Leigh ...	Leigh Corp.	Steam	4.0	2	1
Macclesfield ...	Macclesfield Corp.	Oil	1.72	1	1
Nelson ...	Nelson Corp.	Steam	12.75	6	2
Padiham ...	Lancashire E.P.C.	Steam	31.38	28	2
Radcliffe ...	Lancashire E.P.C.	Steam	53.55	35	2
Rawtenstall ...	Rawtenstall Corp.	Steam	17.62	9	2
Ribble ...	Preston Corp....	Steam	181.1	165	3
Rochdale ...	Rochdale Corp.	Steam	8.5	6	1
Sedburgh ...	Sedburgh E.S. Co.	Oil	0.1	0.1	1
Stockport ...	Stockport Corp.	Steam	97.5	79	3
Stuart Street	Manchester Corp.	Steam	179.75	169	3
Trafford ...	Stretford & District E.B.	Steam	69.0	58	3
Whitehaven ...	Whitehaven Corp.	Steam	2.0	1	3
Wigan ...	Wigan Corp.	Steam	12.0	10	2
Atherton* ...	South Lancashire Transport Co. ...	Steam	9.25	5	2
Total ...			1,780.36	1,566	—

* Not owned by B.E.A. but operated by North Western Division.

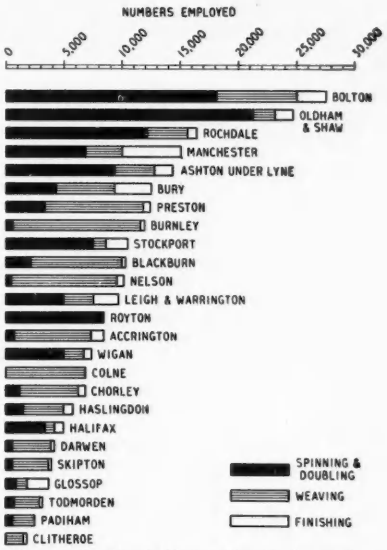
addition a 40 MW extension is in course of construction at Blackburn.

The projection of the Lancashire coal field under the heart of Manchester is linked up with an extremely interesting forthcoming development when Stuart Street generating station will be supplied with coal direct from the coal face through a tunnel.

The following are the primary grid substations associated with most of the scheduled power stations as part of the major transmission system in the Area: Agecroft 90 MVA, Barrow 30 MVA, Barton 120 MVA, Blackburn 60 MVA, Bolton 85 MVA, Carlisle 40 MVA, Chadderton 60 MVA, Hartshead 40 MVA, Kearsley 105 MVA, Kendal 20 MVA, Lancaster 50 MVA, Nelson 30 MVA, Padiham 40 MVA, Rawtenstall 35 MVA, Ribble 60 MVA, Stockport 60 MVA and Wigan 40 MVA.

In assessing electrically any of the supply areas, or for that matter any sizeable area, we regard it as imperative to present a load analysis in one form or another, and one useful method of giving fuller meaning to such an analysis is first to review generally the industrial position in the Area. Here we must again refer to the great inland docks at Manchester, because of the influence they exert over so much of the industry in the Area.

The bearing of the textile industry on the Area is so outstanding and world important that we must give it pride of place here. We think we can hardly do better in this respect than to reproduce partly the block diagram prepared by the Labour Department of the Cotton



Because the North Western Area embraces the most important cotton manufacturing district in the world we present this classification of employment, based on a chart produced by the Labour Department of the Cotton Board

It is not generally appreciated that the great inland docks at Manchester owe their present-day importance to that great civil engineering achievement, the construction of the Manchester Ship Canal

Board, largely because it indicates the lines of demarcation between the major fields of spinning, weaving and finishing. Whereas spinning is mainly centred immediately north of Manchester, e.g., Bolton, Oldham and Rochdale, the emphasis is given to weaving in the towns farther north such as Preston, Burnley, Blackburn, Nelson and Colne, and again in the south at Stockport. The demand of the cotton textile industry on the public supply is about 200,000 kW, the individual supplies ranging from a few kW for auxiliary lighting up to 6,000 kW for large electrically driven mills.

The importance of the North Western Area in the heavy engineering world is brought out by mentioning such household names as Metropolitan-Vickers, Mather & Platt, Ferranti, Laurence, Scott & Electromotors, English Steel Corporation and English Electric. The chemical industry is of very considerable importance in the Area, and among the larger consumers in this field is the I.C.I. There is a strong representation of the rubber industry in and around Manchester, and an outstanding factory is the Dunlop works in the city, which consumes about 15 million kWh per year with a demand of about 5,000 kW.

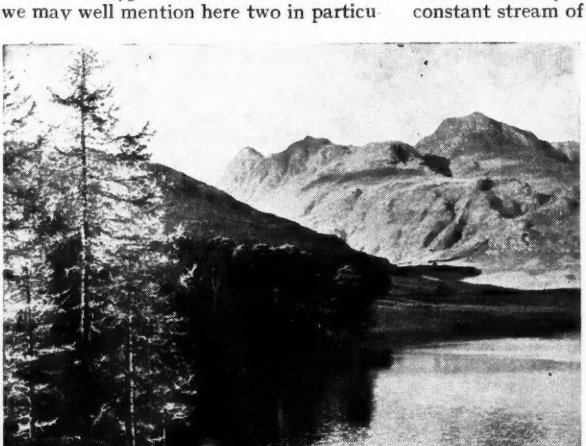
There are 73 collieries in the Area, but we may well mention here two in particular—Mosley Common with a prospective demand of 8,000 kW and Bradford with a prospective demand of 7,000 kW.

Quarries producing principally limestone and cement ingredients are found frequently in the hills which make up the natural boundaries of Lancashire, Cumberland and Westmorland, and among these an interesting type of night load is being developed for tar heating in connection with the production of tarred chippings for road making.

The application of electricity to the refining of oil and oil products represents collectively one of the largest consumer groups in the Area, and lower peace-time production still calls for a demand of 15,000 kW with an annual consumption of over 100 million kWh.

Manchester is also the greatest newspaper production centre outside London. In Kemsley House, Manchester claims the world's largest office devoted to newspaper and periodical production, and it is responsible for the consumption of about 5 million kWh per annum. The important shipbuilding industry at Barrow calls for special reference, and so do food production, paper making and the dock installations.

With Blackpool drawing thousands of seasonal holiday makers and the almost constant stream of tourists through Lakeland the holiday industry cannot be neglected in such an assessment. Finally, another but more direct word locationally about agriculture: the flat lands south of the Ribble estuary, noted for root crops; the Fylde, the tract stretching west of Preston to Blackpool, and north to Morecambe Bay, with its notable dairy farming and prime stock-rearing pasture lands; and the sheep-



Where Alpine flora is found and stoats take on the white coat: Blea Tarn and Langdale Pikes

(Aerofilms photo)

With Blackpool drawing holiday makers in their thousands, the holiday industry is of great importance

farming speciality of Cumberland and Westmorland are all important factors in this National Survey.

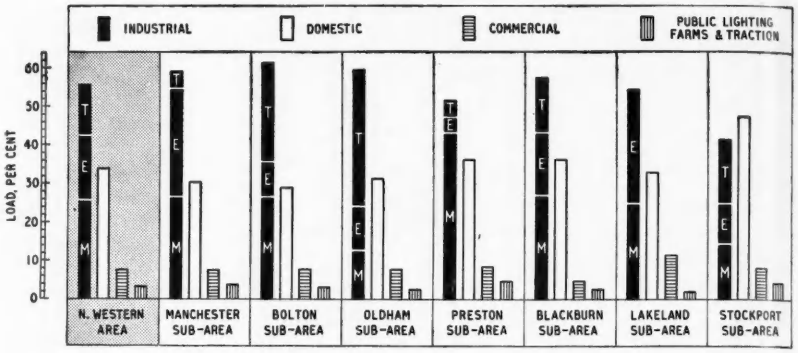
Another useful support of the load analysis proper is the locational picture of urban and rural populations and consumers and consumptions in relation to actual areas covered, and a convenient presentation of this is the appended table arranged in Sub-Area and Area order.

We can also classify the consumers as follows: Domestic, 1,127,971; commercial, 143,035; industrial, 18,932; and agricultural, 10,287. The aggregate m.d. on all the supply points for the year ended 31st March, 1949, was 1,304,822 kW.

With the foregoing preparation we are able to present the load analysis proper on a consumption basis in diagram form for the North Western Area and the Sub-Areas. This load analysis should also be studied in connection with the specially prepared electrical assessment map for which, as a characterizing background, we have adopted electrical load density. Transmission lines below 33 kV are not shown on the map. The Bolton Sub-Area headquarters is temporarily situated in Manchester, and the Lakeland Sub-Area headquarters at Barrow.

NORTH WESTERN AREA: POPULATION, CONSUMERS AND SALES

Sub-Area	Area in sq. miles	Population Urban	Population Rural	Consumers (1st April, 1949)	Consumption, 1948/49, thousands kWh
No. 1 (Manchester) ...	119	1,189,000	—	362,506	1,358,994
No. 2 (Bolton)	495.4	754,000	196,000	260,113	882,653
No. 3 (Oldham) ...	188.9	527,000	4,000	161,392	522,075
No. 4 (Preston)	513.7	453,500	72,500	157,743	712,734
No. 5 (Blackburn) ...	600.1	450,000	36,000	160,437	413,149
No. 6 (Lakeland) ...	2,646	288,500	187,500	109,052	329,316
No. 7 (Stockport) ...	277.7	252,000	85,000	88,982	224,913
Area Totals	4,830.8	3,924,000	581,000	1,300,225	4,443,834



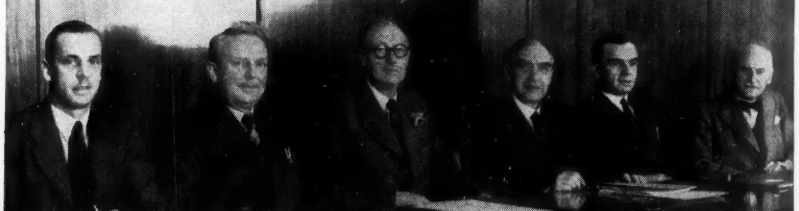
By the courtesy of the Commercial Department of the North Western Electricity Board we are able to present our load analysis proper in diagram form. The industrial load is sub-divided to show; T=textiles, E=engineering and M=miscellaneous industries. There is no traction load in Lakeland Sub-Area

The tariff position in the Area is important and calls for a general review. On Vesting Day there were about 800 different tariffs which had been created by the exceptionally large number (76) of undertakings in the Area, but this number of tariffs was considerably reduced when, in August, 1948, lighting flat rates above 6d per kWh for quarterly consumers and 6.5d per kWh for prepayment consumers were reduced to these maximum figures, while the running charges in all domestic and certain commercial tariffs below 0.75d per kWh were raised to that figure. The steps towards standardization have left untouched the fixed charges of the tariffs and have not affected the many domestic flat rate and block tariffs which range from 0.75 to 6.5d per kWh.

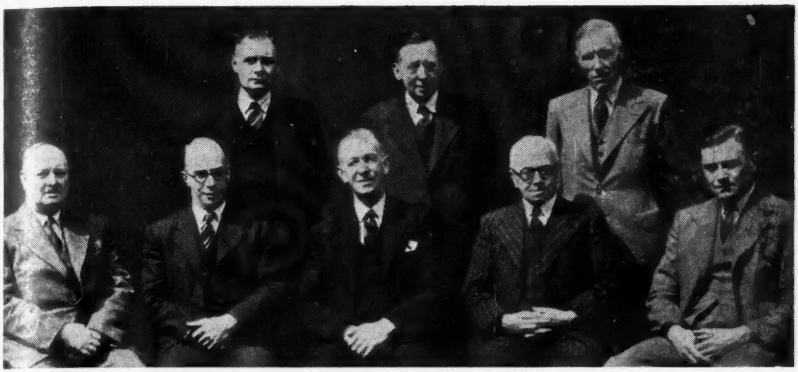
About 61 per cent of the domestic consumers are charged on two-part tariffs, the fixed portions of which are based on either rateable value, floor area, chargeable rooms or, in an odd case or two, on maximum demand or installed capacity. A further 20 per cent of the total domestic consumers are charged on flat rates and 13 per cent on fixed block tariffs.

While some of the former supply undertakings had sought to evolve special two-part tariffs for their farm consumers, relating the fixed charges to the measurements of the outbuildings or to the farm acreages, other undertakings adapted existing lighting, heating, power or two-part domestic tariffs to farm requirements. The commercial and institutional consumers are supplied mostly on flat and block rate tariffs.

There are in the Area 87 service centres



The North Western Electricity Board executive team. Left to right: Mr. A. O. Johnson, Mr. O Howarth, Mr. R. A. S. Thwaites, Sir Joseph Hallsworth Mr. James W. Chant and Mr. A Heaton



The North Western Division executive team. Front row, left to right: Messrs. J. R. Thompson, J. L. Ashworth, C. T. S. Arnett, H. Tweedale (who has retired since the photograph was taken), and C. R. Watson-Smyth. Back row, left to right: Messrs. P. H. Flatt, J. Foden and J. Almond

and we name them in Sub-Area order as follows.—

Manchester Sub-Area.—Altrincham, Cheadle, Cheadle Hulme, Eccles, Irlam, Manchester, Sale, Salford, Stretford and Ormston. *Bolton Sub-Area.*—Bolton, Bury, Chorley, Earlstown, Farnworth, Horwich, Leigh, Leyland, Newton-le-Willows, Ormskirk, Radcliffe, Ramsbottom, Swinton, Turton, Walkden, Whitefield and Wigan. *Oldham Sub-Area.*—Ashton-under-Lyne, Dukinfield, Glossop, Hyde, Middleton, Mossley, Oldham, Rochdale, Stalybridge and Whitworth. *Preston Sub-Area.*—Blackpool, Bentham, Fleetwood, Freckleton, Kirkham, Lancaster, Lytham, Morecambe, Preston and St. Annes. *Blackburn Sub-Area.*—Accrington, Bacup, Blackburn, Brierfield, Burnley, Clitheroe, Colne, Darwen, Gt. Harwood, Haslingden, Nelson, Padiham, Rawtenstall and Settle. *Lakeland Sub-Area.*—Appleby, Barrow-in-Furness, Carlisle, Carnforth, Cockermouth, Dalton-in-Furness, Egremont, Kendal, Keswick, Penrith, Sedbergh, Ulverton, Whitehaven and Workington. *Stockport Sub-Area.*—Bramhall, Buxton, Chapel-en-le-Frith, Marple Disley, Hazel Grove, Macclesfield, New Mills, Poynton, Stockport and Wilmslow.

All the foregoing systems, installations, premises and conditions were taken over (collectively) by the new organizations from an exceptionally large number of supply undertakings, viz., 76, which we list in Sub-Area order for convenience as follows:—

Manchester Sub-Area.—Altrincham Electric Supply, Ltd.; Cheadle and Gatley U.D.C.; Eccles Corporation; Manchester Corporation; Sale Corporation; Salford Corporation; Stretford and District Electricity Board.

Bolton Sub-Area.—Ashton - in - Makerfield U.D.C.; Atherton U.D.C.; Bolton Corporation; Bury Corporation; Farnworth Corporation; Heywood Corporation; Hindley U.D.C.; Horwich U.D.C.; Lancashire Electric Power Co. (in part); Leigh Corporation; Newton-le-Willows U.D.C.; Ormskirk Electric Supply Co., Ltd.; Radcliffe Corporation; Swinton and Pendlebury Corporation; Turton U.D.C.; Wigan Corporation.

Oldham Sub-Area.—Ashton-under-Lyne Corporation; Littleborough U.D.C.; Middleton Corporation; Milnrow U.D.C.; Oldham Corporation; Rochdale Corporation; Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board; Whitworth U.D.C.

Preston Sub-Area.—Blackpool Corporation; Fleetwood Corporation; Lancaster Corporation; Lytham St. Annes Corporation; Morecambe and Heysham Corporation; Preston Corporation; Thornton Cleveleys U.D.C.

Blackburn Sub-Area.—Accrington Corporation; Bacup Corporation; Blackburn Corporation; Brierfield U.D.C.; Burnley Corporation; Clitheroe Corporation; Colne Corporation; Darwen Corporation; Haslingden Corporation; Nelson Corporation; Padiham U.D.C.; Rawtenstall Corporation; Lancashire Electric Power Co. (in part); Settle and District Electricity Co., Ltd.

Lakeland Sub-Area.—Barrow-in-Furness Corporation; Cark and District Electricity Co., Ltd.; Carlisle Corporation; Grange U.D.C.; Kendal Corporation; Keswick Electric Light Co., Ltd.; Mid-Cumberland Electricity Co., Ltd.; Millom R.D.C.; Penrith Electric Supply Co., Ltd.; Sedbergh Electricity Co., Ltd.; South Cumberland Electricity Supply Co., Ltd.; Ulverston U.D.C.; Westmorland and District Electricity Supply Co., Ltd.; Whitehaven Corporation; Windermere & District Electricity Supply Co., Ltd.; Workington Corporation.

Stockport Sub-Area.—Alderley Edge & Wilmslow Electricity Board; Bredbury and Romiley U.D.C.; Buxton Corporation; Hazel Grove and Bramhall U.D.C.; Macclesfield Corporation; Marple U.D.C.; New Mills (Derbys) U.D.C.; Stockport Corporation; Trent Valley & High Peak Electricity Co., Ltd.

The North Western Board has its headquarters at Cheetwood Road, Manchester, 8, in large single-storey buildings on lease, which, we believe, are the only headquarters buildings of the 29 new organizations with which we are concerned in the survey so far specially built for the purpose they now serve. Sir Joseph Hallsworth, chairman; Mr. R. A. S. Thwaites, deputy chairman; Mr. J. W. Chant, secretary; Mr. A. Heaton, chief accountant; Mr. O. Howarth, chief engineer; and Mr. A. O. Johnson, chief commercial officer, are the headquarters executive team.

The Division headquarters is at British Electricity House, Wilmslow Road, East Didsbury, Manchester, 20, the former headquarters of the North-West England and North Wales Area of the Central Electricity Board. Here Mr. C. T. S. Arnett, the divisional controller, works with the following principal officers as the Division executive team: Mr. J. Foden, transmission engineer Mr. J. Almond, electro-technical engineer; Mr. C. R. Watson-Smyth, chief generation engineer (construction); Mr. J. L. Ashworth, chief generation engineer (operation); Mr. J. R. Thompson, system operation engineer; Mr. P. H. Flatt, divisional secretary; and Mr. A. McLellan, divisional accountant.

We wish to thank Sir Joseph Hallsworth and Mr. C. T. S. Arnett, and their officers for the co-operation and assistance in the investigation which has made it possible for us to publish this article.

Future of Horsley Towers

HORSLEY Towers, near Guildford, in Surrey, was occupied for some years by the Central Electricity Board and was acquired by the British Electricity Authority upon nationalization of the electricity supply industry. Last year a part of the mansion was adapted for residential training courses and the first course, for boiler house staff, was held just before Christmas.

When the B.E.A. headquarters staff is moved to London the whole of the building will be turned into a residential training centre. Mr. J. W. Graely, until recently director of the National Coal Board's Staff College, Nuneaton, has been appointed resident tutor.

British Standard Motors

Suggestions to Initiate Discussion

By A. N. D. KERR, A.M.I.E.E.

THE publication of the Lemon Report has once again focused attention on the need for simplifying and rationalizing engineering equipment, if we are to hold world markets in competition with other well-organized industrial nations. As the most important item in such equipment is usually the electric motor which drives it, undoubtedly some measure of motor standardization would initiate improvements in the equipment which motors drive with benefit to all concerned both at home and overseas.

It is suggested, therefore, that the time is now opportune for manufacturers to reconsider the design and production, and users the application, of a range of British Standard a.c. induction motors for 50 c/s three-phase circuits at 200-550 V, as that range comprises the overwhelming majority of world supplies. They would be of squirrel-cage construction as this is the standard pattern for all applications in which unduly low starting current is not essential. Such motors would also be suitable for many 60 c/s circuits. Consequent on the heavy initial outlay for new patterns, jigs, tools and dies which would be required the machines would have to be in the range of market demands which makes flow production practicable, say, initially 1 to 15 h.p.

Types of Enclosures

Of the various types of enclosures available, the totally enclosed machine with some form of augmented cooling is already fast approaching world popularity. The recognized British Standard enclosure, therefore, in this range should be the totally enclosed surface fan-cooled machine. Screen protected, drip-proof and other enclosures would, however, continue to be available in that range when required, but they would gradually become relegated to the category of non-standard enclosures in favour of the standard totally enclosed machine.

Totally enclosed motors built to B.S.168[1] have no sustained overload capacity. However, they are capable of an excess torque of 100 per cent for 15 sec, and 50 per cent for one minute. In effect they would be rated on the basis of continuous maximum output, the advantages of which were discussed in an earlier article[2].

Temperature Rise

The present 50 deg C temperature rise is now thought to be on the low side for machines with augmented external cooling and 55 deg C is suggested. This is the standard figure used in Canada and the United States of America for totally enclosed machines and it is also the one which was agreed in the war-emergency B.S.1156: 1945[3].

If at the same time as the development of this new B.S. range was being considered a revision of B.S.168 were to be undertaken to bring it more in harmony with the needs of industry as well as of the Services, it would then be possible to have only one standard for medium size rotating machines. Some proposals to this end, particularly as affecting tolerances permissible in manufacture, have already been made[4].

Coincident with the revision of B.S.168 the opportunity should also be taken to standardize dimensions of the new range. Motors designed and built to an up-to-date specification, taking advantage of the improvements in materials and manufacturing techniques of the past decade and interchangeable in fixing dimensions with similar ratings, would be welcome to users because they would be in every way B.S. motors.

The actual dimensions would need to be chosen with great care. They should preferably be such as would command

general acceptance, not only in this country, but also in markets overseas; particularly in markets of such vital importance to us as Canada. It will be appreciated that if standardized dimensions are already available, their adoption on our own standard range would have the advantage of assisting the entry and promoting the sale of British motors in markets now using such dimensions.

One set of such standard dimensions already exists on the North American Continent. They are those of the National Electrical Manufacturers' Association (N.E.M.A.) of the U.S.A.[5] Already a well-known British motor maker has considered their use and in a report published recently[6] has announced their adoption for a range of totally enclosed surface fan-cooled machines which will be shown at the Canadian International Fair in Toronto this summer.

An examination of the N.E.M.A. dimensions, however, discloses that machines complying with them are unduly large when compared with British motors of similar ratings. It might nevertheless be an asset to use these dimensions, but to obtain from the frame sizes concerned their maximum continuous outputs to the revised British Standard, obtaining, for example, 10 h.p. from a frame built to N.E.M.A. $7\frac{1}{2}$ h.p. dimensions. It would then be possible to offer Canadian and American users as well as all those in their overseas markets who have already standardized on N.E.M.A. dimensions a frame size interchangeable in fixing dimensions with the one that they were at present using, having not only the same output but (and this would be a sales advantage to British machines) also an appreciably greater output if desired.

Another item which might also receive consideration at the same time as fixing dimensions were standardized would be the use of metric bearings, which would be of great assistance to us in foreign markets and would bring our own machines into line with world standards.

To the British user any dimensions which represent an alteration from those of the make which he is at present using would be initially an inconvenience; consequently, if dimensions have to be altered, they may as well come into line with another existing standard as introduce an entirely fresh one.

Undoubtedly, however, to the home user the advantage of a new range of British Standard motors with frame sizes of similar ratings having interchangeable fixing dimensions would be that they could retain their existing suppliers and yet in an emergency use alternative makes without disturbing production.

To sum up, it is suggested that the time is now opportune for B.S.168 to be revised to encourage the development of a new range of British Standard motors which would comprise totally enclosed surface fan-cooled squirrel-cage machines of from 1 to 15 h.p., having a temperature rise not exceeding 55 deg C, metric bearings, and fixing dimensions interchangeable for the same ratings.

BIBLIOGRAPHY.

[1] B.S.168; 1936, Industrial electric motors and generators.
[2] "Continuous Maximum Rating," *Electrical Review*, 9th May, 1947 (pp. 749 & 750).
[3] B.S.1156; 1945, A.c. & d.c. motors & generators for Government Department requirements.
[4] "Electric Motor Tolerances," *Electrical Review*, 14th March, 1947 (pp. 391 & 392).
[5] NEMA Standards for Motors & Generators, Pub. No. MG 1-1949, October, 1949.
[6] Trade Announcements, *Electrical Review*, 10th February, 1950. (p. 261).

Incorporated Plant Engineers

UNDER the presidency of Mr. E. G. Phillips, O.B.E., the third annual conference of the Incorporated Plant Engineers will be held at Nottingham from 18th to 20th May, commencing with a civic reception at the Council House. Friday, 19th May, will be devoted to the annual general meeting, other domestic business and works visits to the principal industries of Nottingham. The main speakers will be heard on the Saturday morning. They will include Sir Ernest Smith (a past president of the Institute of Fuel and chairman of the Industrial Coal Consumers' Council) and Mr. Lewis C. Ord, industrial consultant. Except for the Friday evening dinner and dance at the Astoria Ballroom, all the meetings will be held at the Albert Hall Institute. The conference will conclude on the Saturday with motor coach tours of the Dukeries, a golf tournament and theatre parties.

Commercial Travellers

A general meeting of the Electrical Trades' Commercial Travellers Association will be held today (Friday) at the Feathers Hotel, Broadway, Westminster, S.W.1, at 5.30 p.m.

TESTING GENERATOR OUTPUT

Successful Use of A.C./D.C. Comparator Method

DETERMINATION of steam turbo-generator output at different alternator loads for efficiency test purposes has to be done with considerable accuracy. The reason is that an error as small as 0.1 per cent represents 30 kW of output in the case of a 30 MW machine.

Indicating intruments usually employed for tests of this kind have first to be standardized in the laboratory and are always liable to accidental damage on site. There are, moreover, practical limits to accuracy of visual observation, especially when a large number of tests has to be made in quick succession. Even when dial readings have been corrected for known instrument errors, observation errors remain an unknown quantity.

It was for these reasons, when testing a 30 MW turbo-alternator in Kingston "B" power station, South Eastern Division, that Mr. Edmundson, chief testing engineer of the British Thomson-Houston Co., Ltd., in conjunction with Elliott Brothers (London), Ltd., decided to use a comparator, which enables the a.c. output power to be measured by balance with reference to a d.c. potentiometer.

The potentiometer circuit is capable of being standardized with the aid of a standard battery cell, so the comparator itself may thus be standardized in a few moments when set up on the testing site. Although the Elliott comparator (Shotter-Hawkes) is well known as a laboratory instrument and is extensively used for meter testing, this is the first instance of its application to power measurement at a generating station. No special precautions were observed in transit or handling and the suspended dynamometer movement proved amply robust for "outside" use.

The tests were witnessed by a number of well-known personalities in the electrical industry. The a.c./d.c. comparator and its accessories (control box, standard current transformer and 14 V battery), together with a d.c. potentiometer and galvanometer, were set up adjacent to the generator as shown in the accompanying illustration before the day scheduled for the tests. Line current transformers and voltage transformers having known errors were used for coupling into the circuit and suitable switching was provided for the measurement of the power in each phase.

After preliminary tests to enable the operator to become familiar with the procedure, the apparatus was left on circuit overnight and half an hour before the efficiency test was due to start the potentiometer and comparator were re-stan-

Comparator testing output power of 30 MW alternator in Kingston "B" generating station

dardized and the temperature compensator re-adjusted. Two operators were employed, one operating the phase switching and setting the a.c./d.c. balance control on the instrument control box for each reading, the second measuring and logging the power directly from the d.c. potentiometer reading and, between tests, checking the potentiometer and comparator standardization.

Each of the three phases was tested in turn every three minutes for a period of two hours at the full load of 30 MW, followed by one-hour tests at 18 and 24 MW, involving in all some 250 separate readings. The stability of the generator load was such that it was found possible for the operator to maintain a.c./d.c. balance by d.c. manual control, though in practice continuous balance is not required. With a reasonably stable d.c. balancing current, the second operator can take his time in measuring the current by means of the comparator self-contained standard resistance and the potentiometer. The measured voltage on the potentiometer slidewire gives a reading directly proportional to the power at the time of instantaneous d.c./a.c. balance.

Manual adjustments for standardization and temperature throughout the whole test were extremely small and, even if uncorrected, would not have introduced an error greater than five parts in 10,000. The accuracy of power measurement for the instantaneous a.c./d.c. balance of the instrument was of the order of five parts in 10,000, while the accuracy of the total 3-phase power measurement after correction for line transformer errors was estimated to be better than one part in 1,000.

The test demonstrated conclusively that precision a.c. standards have uses other than in the laboratory, provided that they are easily transportable and readily standardized on the testing site.

Electricity for Film Making

THE advantages of having a mobile source of electricity supply for making films out of doors are manifold, and a number of units for this purpose have recently been equipped by Davey Paxman and Co., Ltd.

Perhaps the most interesting of these are the ones supplied to Denham and Pinewood Studios, Ltd., and the Associated British Picture Corporation through Lang Wheels, Ltd., the main contractors. These units, mounted integrally with the chassis of a Foden vehicle, incorporate a Paxman Ricardo 350 b.h.p. diesel engine which is directly coupled through a Wellman-Bibby flexible coupling to a Lancashire Dynamo & Crypto compound-wound open type 200 kW d.c. generator designed to give a ripple-free current. The equipment is furnished with electric starting arrangements and is mounted on a fabricated steel under-base which is supported at ten points by flexible rubber mountings to prevent transmission of noise to the chassis of the lorry.

A feature of the unit is the extensive sound-proofing, carried out by Burgess Products, Ltd. Previously the normal running noise of the sets did not allow direct dialogue recording and it was necessary to take guide tracks, adding the sound later by "dubbing" in the recording theatre. With the soundproofed generating unit full dialogue recording can be obtained when it is as near as 100 yd, the exhaust being inaudible at this distance.

200 kW mobile generating unit for film making out of doors

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Industrial Design

YOUR leading article of 24th February expressed the view that industry should resist a form of dictatorship which you suggest the Council of Industrial Design is attempting to impose in the selection of exhibits for the official Festival of Britain exhibitions.

It must be obvious that selection in an enterprise so complex as the South Bank and other official exhibitions is only possible if carried out by a single impartial authority. Particularly is this true when the exhibition space is so restricted, as on the South Bank site, and when, moreover, the goods must illustrate not only the highest standard of British industrial design but also the story the exhibitions will tell.

Our industrial officers have been recruited for their special knowledge of and experience in those industries whose interests they watch in connection with the Festival. I am confident that these officers, working in conjunction with industrial panels nominated by each industry, will achieve a good representation of industry without the imposition of a dictated style.

Finally, the whole work of this Council is directed to fostering a distinctive British character in industrial design in order that this country may regain its old leadership in this vital aspect of industrial production. GORDON RUSSELL,

London, S.W.1. *Director,*
Council of Industrial Design.

E.C.A. Branch Dinner

IN the reference to the recent South Kent Branch dinner in your issue of 24th February my name is mis-spelt and this company is described as "Pooley & Hunt."

Also the speech has been misreported. I emphasized the importance of co-operation between manufacturer and wholesaler on the one side with the electrical contractor on the other side, stressing the willingness of the manufacturer to give demonstrations and offer every technical assistance to the contractor in the sale of his products.

J. DENIS POOLEY
(Pooley & Austin Ltd.).

London, S.W.1.

[We regret these errors in our report which came from a local correspondent. —EDITORS, *Electrical Review*.]

Cable Loop Tests

IN his article on this subject (24th Feb.) Mr. G. W. Stubbings demonstrates mathematically that the error in yards in a Murray loop test is proportional to the cross sectional area of the cable. May I suggest that this is too obvious to require mathematical proof as, since the cable loop forms an effective "short" across the galvanometer terminals, it is easily appreciated that a larger deviation from the true balance position will be necessary to cause a galvanometer deflection when shorted by a low resistance cable, always providing that the same slide wire and galvanometer are used. From the same reasoning it is also obvious that there is an optimum resistance for both slide wire and galvanometer for maximum sensitivity, which problem was answered, I think, by Clark Maxwell.

In practice one is concerned mainly with different lengths of very similar cross sections and proceeding with the idea of the effective short circuit formed by the cable loop across the galvanometer it is again obvious that the deviation from balance required to produce deflection will be almost inversely proportional to the cable length. As, however, the error in yards is directly proportional to the product of deviation and length, the error is clearly independent of the cable length when using the same apparatus. May I suggest that this is the salient

feature of Mr. G. W. Stubbings' article.

Reverting to practice, Mr. Stubbings' formulæ demonstrate that equal deviations, plus and minus, will cause corresponding positive and negative deflections of the galvanometer for positions very near balance. One is thus able to interpolate the actual null positions, so that the error due to the finite current required by the galvanometer is very small indeed. Errors in measurement of the geographical position of the presumed fault are almost always in excess of instrument errors and often constitute the major difficulty of accurate fault location.

K. FOWKES, A.M.I.E.E.
Leamington Spa.

Increasing Production Efficiency

FOR nearly twenty years a wide range of cables has been produced at the Wandsworth factory of Wandleside Cable Works, Ltd. (a subsidiary company of Falk, Stadelmann and Co., Ltd.), including rubber, plastic, textile and lead-covered cables in sizes of from 1/.044 in up to 37/.103 in, coaxial cables, aerials and the usual range of flexibles. The company supplies cables to leading authorities and during the last six months some 60 per cent of the total cable produced has been exported.

Although comparatively small, the plant has been run on most efficient lines, but now the management has planned an all-out drive for increased production efficiency by re-organizing the manufacturing arrangements on a "quality-control" basis. In this way it is hoped to avoid wastage of man-power and to improve the product.

Cable making lends itself readily to production line testing without interrupting the flow of work. Check tests have always been carried out at Wandleside, but now that new physical and chemical laboratories have been established to work in conjunction with the existing electrical laboratory, the resulting product will receive much closer attention. These laboratories will have a total staff of five, three of whom will be engaged on testing and inspection work in the factory, while the other two will find full employment in the laboratories.

The equipment in the physical laboratory includes a tensile testing machine and a stretching rack for determining the breaking point and elastic properties of rubber, plastics, and textiles. For examining the cable insulation or sheathing there is a vernier microscope and the tensile strength of wires and textiles can be measured on a tensometer. In the chemical laboratory all the necessary apparatus is available for the chemical analysis of both raw materials and finished products.

Another development in the works is the provision of fully automatic process control equipment for the vulcanizing ovens and temperature and linear controls at various other points in the production line. Complete electrical test gear is also stationed within the production flow channels of the various types of cable manufactured.

The two new laboratories were inaugurated on Wednesday this week by Mr. Hugo Falk, chairman of Falk, Stadelmann & Co., Ltd.

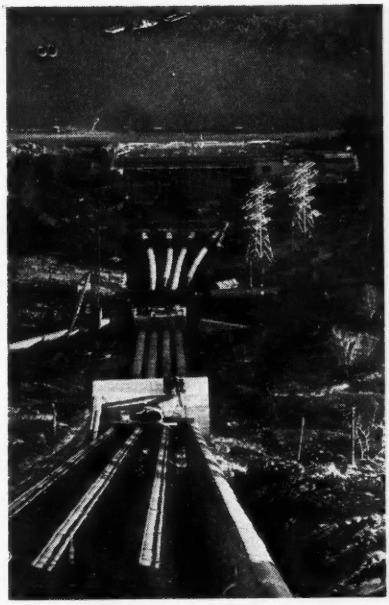
Part of the physical testing laboratory

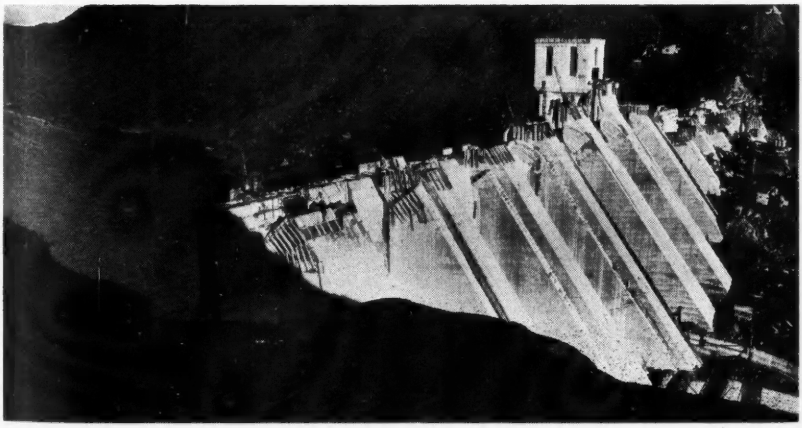
LOCH SLOY POWER STATION

First Set Started Up

ANNOUNCEMENT was made on Monday last that the first of the four main turbo-alternators at the new Loch Sloy hydro-electric power station of the North of Scotland Hydro-Electric Board had been started up. This indicates a considerable advancement in the construction of the project as a whole. It is a single power station project which utilizes a catchment area of 32 sq miles on the high lands about Ben Vorlich, Ben Ime and Ben Lui between Loch Lomond and Loch Fyne to the north.

A concrete buttress dam at the south end of Loch Sloy will raise the level of the Loch sufficiently to impound enough water to provide for the generation of 20 million kWh. In consequence of the high rainfall in the area of about 120 inches per year the scheme is designed for peak-load operation. A tunnel through Ben Vorlich passes the water on to a pipe-line which finally feeds into four pipes each seven feet in diameter down a steep slope to the power station. The generating plant will comprise four vertical Francis turbines operating under a gross head of 910ft and each driving a 32,500 kW alternator. There is also a 450 kW Pelton wheel set for supplying auxiliaries. Generation will be at 11 kV and the alternators connected solid to 11/132 kV transformers which are linked by overhead lines to a main switching station about a mile from the power station.

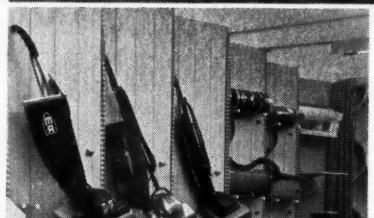




Above: There is a quadruple pipe line-down to the power station on the western shore of Loch Lomond. Below: The dam will impound sufficient water to generate 20 million kWh

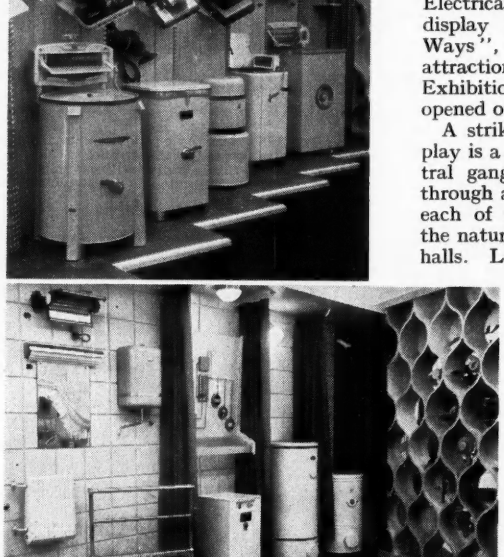
Ideal Home Exhibition

Up-to-date Electrical Labour-saving Methods



THERE are more electrical ways of saving hard work in the home and providing more leisure and better home entertainment than the general public realizes. There are now on the market about 2,000 pieces of electrical equipment for home use. About 270 of these have been selected by the British Electrical Development Association for display in its "Palace of Electrical Ways", one of the main centres of attraction at this year's Ideal Home Exhibition at Olympia, London, which opened on Tuesday.

A striking feature of this E.D.A. display is a 25-yard long vista from the central gangway of the Grand Hall down through a series of illuminated archways, each of which shows in symbolic form the nature of the displays in the adjacent halls. Large "honeycombs" at the end of each section provide an attractive setting for small electrical appliances and look particularly colourful when viewed from the outside. On entering the exhibit the first hall on the left deals with "Washing and Chores". Then come the Halls of "Bedroom and Bathroom Requisites" and "Heating and Ventilating Ideas", terminating in the largest section devoted to "Cooking". On the return through the



Three views of the E.D.A. exhibit,

archways there are the Halls of "Food Preparation and Preservation" and "Household and Lighting".

The cooking section is particularly interesting. Representatives of practically every make of standard cooker are arranged in three groups drawing attention to hotplates and controls, oven facilities and plate warming drawers. A corner indicating a modern kitchen layout includes a Revo overseas model cooker, while a separate display shows other special types, a Moffat unit, a Parnall cooker for the American market and a Gillott Electrosteam model. Breakfast and table cookers occupy yet another section. Further items of particular interest for use in the kitchen include the Kenwood "Chef" mixer; the Horstmann time control; the Deepfreeze "Duocold" combination refrigerator, which, besides having a normal storage compartment, has a special section for frozen foods; and the Walter ozonizer, which prevents cooking odours from penetrating into the house and maintains constant fresh conditions.

Among home laundry equipment the "Washette" dwarf washer is accompanied by another new Fisher model of larger capacity (9 lb) which can be fitted with a heating element if desired. Rotary ironers are represented by the "Oprim" table unit and the Hotpoint apparatus, which fits on the washing machine drive. The new "Smoothie" universal voltage travelling iron made by Lucas Holder, Ltd., is heat controlled. A vacuum cleaner in light colours (Morphy Richards), a wall fan heater (Delaney Galley) and an illuminated plinth (Rowlands Electrical Accessories) are other items which are attracting attention. In the "Household and Light" Hall three displays cover lighting equipment to harmonize with period, modern and "popular" styles of furnishing.

Demonstrations of electric cooking are being given throughout the day on the Ministry of Food stand by electrical housecraft advisers of the London Electricity Board.

An idea of the way electricity is used in a New Zealand home is given by an example of a "State" house of which 33,000 have been built for the Dominion Government. The house, which was brought to this country in sections, has an all-electric kitchen, an electric water heater and a washing machine, and is particularly well supplied with plug points. A refrigerator is provided in the meals alcove. The whole of the electrical equipment of the house has been undertaken by the English Electric Co., Ltd., which on its own separate stand has a display comprising its recently introduced television equipment, its three principal cookers, which are now fitted with aluminium sprayed hotplates, a washing machine, a glass plate warmer, a 6.4 cu ft refrigerator and other appliances.

Two novel devices have been adopted on the Elexcel stand to draw attention to special features of the improved version of the "K.108" cooker, which can now be supplied with a drawer at the bottom and can also be fitted with a d.c. thermostat. A series of glass cubes containing various dishes demonstrate the large oven capacity, and visitors are

The Elexcel stand draws attention to special features of the improved model K.108 cooker

invited to operate the oven thermostat and see for themselves, on illuminated panels, the correct temperatures for cooking different types of foodstuffs. Progress in the design or irons is indicated by another striking display. A new artificial coal or log fire (the "Calder"), a reflector fire available in both portable and wall-mounting versions, and a "Woolton" fire with an improved guard are also to be seen on this stand.

A cooker fitted with wheels to enable it to be moved out for cleaning purposes is an innovation to be found among the Belling display, which also includes an imitation coal effect unit without heating elements for fitting into a coal grate, a 3 kW model of the "County" fire, a two variations of the company's warming cabinet, one in the form of a trolley and the other with a glass back as well as front. In addition to their table cooker, Stokes Appliances demonstrate an electromagnetic fountain.

A modified version of the "Prestcold" S472 refrigerator incorporates a new door catch which can be opened with the elbow, a frozen food compartment, improved wire trays with safety catches, a glass top to the "Crispator", and the light in a new position. On the Frigidaire stand a special feature is made of the new "Meter-Miser" sealed compressor unit which has only three moving parts. The 1950 model Kelvinator unit type E.P.3 though measuring only 23in by 20in has over 6 sq ft of shelf room; model E.7 has an interior light, a crisper, vegetable bin, five-way shelf and a large frozen food compartment.

The improved S.472 "Prestcold" refrigerator and a Belling cooker on wheels

Among a very large number of food mixers exhibited an especially interesting new model just brought out by Vactric can also be used, among other things, for cleaning shoes, polishing silver, floors, cars, etc., and as a portable drill. On another stand the manufacturers show their full range of vacuum cleaners and floor polishers. Other makers of this class of apparatus include Hoover, British Vacuum Cleaner & Engineering Co., Tellus, Bylock, Electrix, Electrolux, Fleet Electrics, Columbus, and the Water Softener & Vacuum Cleaner Service.

Washing machines are well represented by Hoover, B.V.C., Servis, Thor, Bendix, Fisher (Oldham) and others, while makers of heating appliances include the Graviner Mfg. Co., Bratt Colbran and Bertram Thomas. Besides showing their full range of domestic electrical, radio and television apparatus, Electric & Musical Industries (H.M.V.) introduce a new room thermostat. A radio set costing under £7 is demonstrated by Rusal Sales. "Switchmatic" radio remote control units, combined table lamps and loudspeakers and a new spherical loudspeaker are products of C.M.C. (Switchmatic).

Standard lamps incorporating 4ft fluorescent tubes are among various types of lighting fittings shown by the General Lighting Equipment Co., and period and modern fittings displayed by Philip Shaw (Contractors) include chandeliers and wall brackets in crystal, Venetian and coloured glass, carved wood, metal and wrought iron. Linolite show an extensive range of decorative and commercial fittings for fluorescent and filament tubular lamps.

Two Ardente hearing aid developments are a unit completely incorporated in a hat and a neutral coloured link for use between the receiver and the ear, enabling the actual earphone to be completely concealed. The "Ossicaide" R.P.14 model is believed to be the smallest hearing aid yet produced.

Special features include a modern laundry at work, complete with the latest types of electrical equipment.

The exhibition will remain open until 1st April.

Commerce and Industry

The King's Speech
Engineering Wage Claim

THERE was little of directly electrical interest in the King's Speech at the opening of Parliament on Monday. Reference was made of a measure to provide a uniform code for regulating the breaking-up of streets by public utility undertakings. The Iron and Steel Act was not mentioned in the Speech, but in the subsequent debate the Prime Minister said that nothing could be done until 1st October next; he added that it was the Government's purpose "to give effect to Acts passed by Parliament."

Contract Price Adjustment Formulæ

The following are the latest figures for use in the B.E.A.M.A. contract price adjustment formulæ: the rate of pay for adult male labour at 11th February is deemed to be 115s (unchanged). Cost of materials: the Board of Trade index figure for intermediate products as on 11th February is 277.0 and is the figure for January (against 271.2 for December).

Scottish Dairy Show

An attraction at the recent Scottish Dairy Show, held in the Kelvin Hall, Glasgow, was the South West Scotland Electricity Board's stand, with the theme "Electricity on the Farm Means More Hands for the Land." The stand was divided into three main sections—a byre, a producer-retailer dairy and a general display. In the byre, an interesting feature was a section of a cow stall floor, warmed with "Panelec" heaters embedded in the concrete and thermostatically controlled. In the dairy, emphasis was on steam raising, of which three different methods were in operation, and on milk cooling by the chilled water system. Included in the general display were several kinds of electrically driven water pumps, hand tools, hammer mills, a farm food boiler and root cutter. In South West Scotland, where farming is mainly connected with milk production, it is interesting to note that over 45 per cent of the total of 10,000 farms in the Board's area already have electricity, and during the past 12 months 280 farms have been connected.

The S.W. Scotland Electricity Board's display at the recent Scottish Dairy Show

Wages in the Engineering Industry

At a meeting of the National Council of the Amalgamated Engineering Union on 2nd March, it was decided to recommend the Executive Council of the Confederation of Shipbuilding and Engineering Unions to take a ballot of members on the wages question. It was proposed that members should be asked to vote either for strike action or for the submission of the unions' £1 a week claim to arbitration. The matter was to go before the Executive Council at a meeting yesterday (Thursday).

The Engineering and Shipbuilding Employers' Federations had rejected the claim of the unions for £1 a week increase, which was based on a contention that it could be

met out of the industries' profits. The Electrical Trades Union has called upon the Confederation of Shipbuilding and Engineering Unions to "launch an immediate national campaign to show that the granting of a wage increase of £1 a week out of profits to the engineers will help to prevent unemployment."

U.N. Building Contracts

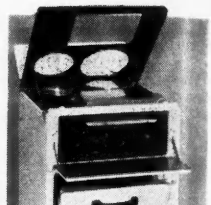
Following up the report on contracts for the United Nations headquarters from the Washington correspondent of *The Times* (referred to last week) the United Nations correspondent of that paper states that Mr. Trygve Lie, the U.N. Secretary-General, has said that no low bids had been received from abroad which met the specifications. This, says the correspondent, ignores the fact that specifications have sometimes been altered after the submission of tenders.

Mr. Lie said that the general contractors were under heavy penalty to complete the building by next January, but the correspondent points out that time could hardly have entered into some of the subsidiary contracts which had been placed with American firms. Contracts have yet to be signed for the general assembly hall and Mr. Lie has said that every consideration will be given to inquiries regarding the furnishing and equipment of this building, much of which, it was hoped, could be obtained outside the United States.

New Demonstration Cooker

A novel power-driven model for demonstrating at exhibitions and showrooms the outstanding features of their C.49 cooker has been introduced by British National Electrics, Ltd. An electric motor concealed behind the cooker automatically opens and closes the oven and hot-cupboard doors, revealing the capacity of these two compartments; raises and lowers the hob, showing the easy access for cleaning purposes; and opens and closes the utensil drawer in the base of the cooker. This cycle of operations is performed continuously.

A power-operated demonstration electric cooker



The demonstration cooker has been so successful at recent exhibitions that the company has had to build more to meet the requests received from Electricity Boards and other customers.

A.E.I. Exhibition

An exhibition was recently held in the Ediswan showrooms at 155, Charing Cross Road, London, W.C.2, where an impressive array of domestic products manufactured by the companies of the A.E.I. group was displayed privately to executive personnel. Visitors to the exhibition included the Rt. Hon. Oliver Lyttelton (chairman of A.E.I., Ltd.), Dr. H. W. H. Warren (managing director, A.E.I., Ltd.), Mr. E. H. Ball (managing director, B.T.H. Co.), Mr. H. Butterworth (managing director, Edison Swan Electric Co., Ltd.), and Mr. F. Spencer (managing director, Hotpoint Electric Appliance Co., Ltd.), Mr. I. R. Cox (managing director, Metropolitan-Vickers), and Sir Felix J. C. Pole.

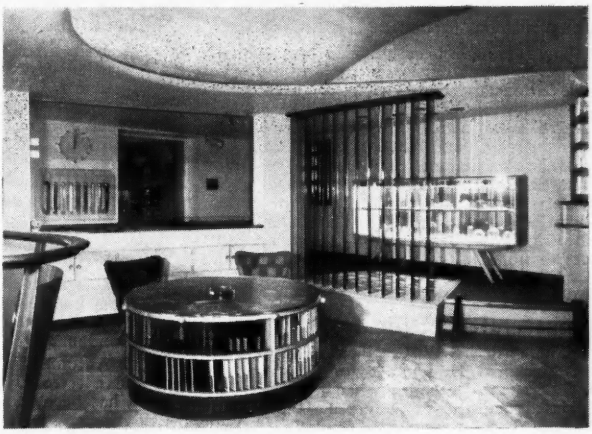
A general view of the recent A.E.I. Exhibition held at the Ediswan showrooms in London

Change of Address

The headquarters of the Thurrock District of the Eastern Electricity Board are now at Maidstone Road, Grays, Essex (telephone: Tilbury 4401).

London Glassware Showroom

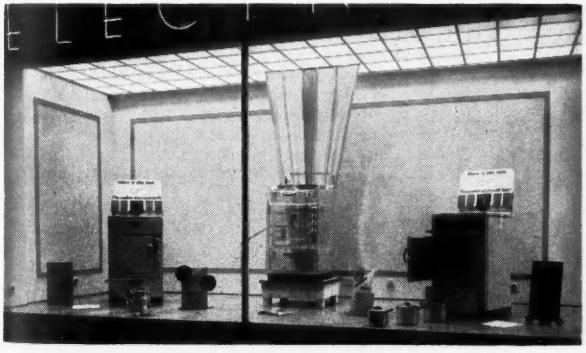
New West End showrooms have been opened by Pilkington Brothers, Ltd., for the display of some of the applications of the company's glass, at Selwyn House, Cleveland Row, St. James's, S.W.1. The first floor of these premises has a spacious Louis XVI drawing-room, and considerable ingenuity has been shown in converting it into a showroom. Most of the exhibits will appeal mainly to the builder and architect, and the display includes pressed and blown glassware, "Insulight" hollow glass blocks and a string of glass h.v. insulators. Leading from the main showroom is a smaller showroom which has a bathroom displaying the decorative and functional application of "Vitrolite" for wall treatment. There are also examples of combinations of decorative glass processes in conjunction with artificial lighting, and an example of the decorative effect obtainable from fluorescent paint and ultra-violet light in connection with glass decoration. Entrance to the showroom is through a pair of "Armourplate" doors.



Part of the new London showroom of Pilkington Brothers, Ltd.

"Creda" Cooker Display

In the accompanying picture we show a display of "Creda" cookers made by the Simplex Electric Co., Ltd., recently arranged in the Leicester showroom of the East Midlands Electricity Board. The main feature of the display was the company's demonstration "Perspex" cooker.



A "Creda" cooker display by the East Midlands Electricity Board at its Leicester Sub-Area showroom

Payment for Rural Lines

At a recent meeting of the Wilts County Branch of the National Farmers' Union, the Parliamentary Committee (according to the *Wiltshire Times*) reported receipt of a resolution from Chippenham Branch asking that the Southern Electricity Board be pressed to introduce a system of line rentals for electricity supply similar to that recently announced by the South Western Electricity Board. It was reported that the N.F.U. Electricity Adviser did not support this proposal, nor did the Southern Electricity Board contemplate introducing it in its area. From information available, the Committee was of opinion that it would be a more expensive long-term method of securing electricity supply. In addition, it might prejudice negotiations between the N.F.U. and the British Electricity Authority for the abandonment of the capital charge system.

Import Restrictions Removed

Changes have been made to previous lists of goods which have been freed from import restrictions and to the list of electrical goods the following have been added: Lead-acid and alkaline accumulators, electrodes (furnace, lighting and battery), insulating cloth or tape and filament or discharge (including fluorescent) lamps. A further list of goods which can be imported without individual licences as from 1st March includes piezo-electric plates, bars, rods or blanks, mounted or unmounted and piezo resonators and oscillators.

Housecraft Certificates

The 23rd E.A.W. Certificate Examination in Electrical Housecraft for Teachers was held on 10th December when forty-two candidates qualified for the certificate, bringing the total to 1,502. The Association's Certificate Examination in Electrical Housecraft for Demonstrators and Saleswomen was held on 8th December, forty-six candidates qualifying for the certificate. The total number of certificate holders is now 1,551.

Port Talbot Strike

An award was issued on Tuesday by Dr. D. T. Jack, King's College, Newcastle, who was appointed arbitrator by the Minister of Labour, in the dispute between W. J. Furse & Co. (Manchester), Ltd., and its employees at the works of the Steel Company of Wales, Port Talbot. As we reported last week, the dispute arose from the transfer of Mr. Chadwick, a shop steward, with other men, from the job on account of redundancy.

Dr. Jack stated that he was unable to find on the evidence submitted that there existed any accepted practice within the industry whereby shop stewards or senior shop stewards were excepted from the application of the usual procedure with regard to redundancies or transfers of labour, nor was he able to find that in the present case the decision to transfer Mr. Chadwick to Manchester was an act of victimization. The company was not acting unreasonably in transferring Mr. Chadwick from the Port Talbot site, and if the Electrical Trades Union felt that it had a grievance it should have taken action under Clause 19 of the National Working Rules to have the matter referred to the District Joint Industrial Council. This it did not do, and Dr. Jack said that he was unable to accept the contention that it was the duty of the company to make such a reference. Consequently, he could find no justification for the stoppage of work.

"Mechanical Handling"

The March issue of *Mechanical Handling* is a special "Advance Show Number," in which details are given of the Mechanical Handling Exhibition and Convention (Olympia, 6th to 17th June) organized by the journal. These include the names and addresses of exhibitors and a Convention programme showing the dates, times, speakers and chairmen of the 17 meetings at which papers are to be read.

Trade Announcements

The telegraphic address of **A. H. Hunt, Ltd.,** has been changed to "Capacitors-Put-London," and the cable address to "Capacitors-London."

The Automatic Control Gear Department of the **Electro Dynamic Construction Co., Ltd.,** has been transferred to the company's Bridgwater Works, which will in future be devoted chiefly to the extension of this new department's activities. The manager is Mr. B. Feltbower.

Barries Electrical Agencies, Ltd., King Street, Brighton, 1, have been appointed agents for the Dexray Engineering Co., Ltd., Manchester, manufacturers of metal-clad switchgear.

Mr. John H. Scott informs us that the business established under his name has now been converted to a limited liability company with the title **John H. Scott Electric, Ltd.**

A new branch has been opened by **J. M. Webber & Co., Ltd.,** wholesale electrical distributors, at 266, Glossop Road, Sheffield, 10 (telephone: Sheffield 23552).

A trade counter has been opened by **Electrical Appliances & Accessories, Ltd.,** at 345, Green Lanes, Harringay, London, N.4 (telephone: Stamford Hill 9328).

Catalogues and Lists

Hoover, Ltd., Perivale, Greenford, Middx.—Sales promotion material prepared for the spring-cleaning electric cleaner sales campaign, including particulars of the Hoover spring window display contest.

H.V.E. (Electric), Ltd., 54, Merrion Street, Leeds.—Catalogue of "Thermalair" tubular heaters, convectors, panel and fan heaters, control units, thermostats and exhaust fans.

Crane Packings, Ltd., Slough, Bucks.—Technical brochure dealing with mechanical seals.

Partridge Wilson & Co., Ltd., Davenset Electrical Works, Leicester.—Catalogue (No. 214) describing a selection of the company's products including power transformers, industrial rectifiers, battery chargers, etc.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PROJECTS

Pig Farrowing Heater

TO reduce the mortality amongst young pigs due to the cold a special farrowing heater has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The unit, which can equally be used in places where other young stock is raised, consists of a chromium-plated reflector fitted with a 1 kW rod-type element and a wire mesh guard. A robust steel bracket enables the heater to be mounted on a horizontal or vertical surface. Three yards of 3-core tough rubber covered cable are supplied. The price is £4 10s (no purchase tax).

Crocodile Clips

Several additions have recently been made to the range of crocodile clips made by A. F. BULGIN & CO., LTD., By-Pass Road, Barking, Essex. Apart from four general-purpose types of 25 A rating, to supplement the original 5 A size, there are three patterns of up to 5 A rating which are specially made for gripping flex strands and fine wire, together with a further four 25 A models shaped to grip car battery lugs and rods.

Milk Saucepan

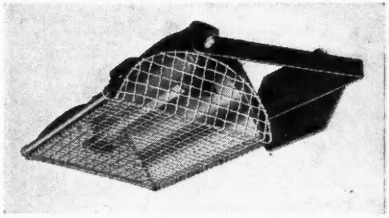
The "Mysto 2230" electric milk saucepan made by W. T. FRENCH & SON, LTD., Mysto Works, Browning Street, Birmingham, 16, is of polished copper, tinned inside and fitted with a clamp-on element. Black moulded material is used for the handle as well as for the knob on the lid, and a lip has been fashioned for pouring. Six feet of three-core flex and a connector are supplied. The two-pint 400 W size costs 52s, the three-pint 900 W size 55s, and the four-pint 900 W model 59s.

Table Cooker

To meet the very large demand from the one-roomed flat, WARNFORD CONSTRUCTIONS, LTD., 1, Chesterfield Street, London, W.1, have brought out the "Mastercook" combined electric griller, toaster, boiler and fryer. As the unit cooks both above and below the hot-plate at the same time it is possible to prepare a full meal in one operation. The loading is only 750 W so that it may be safely used on a lighting circuit. The apparatus measures 9in by 8in by 4in high and weighs 5¼ lb complete with grill pan and toast shelf. Including a heat-resisting glass frying-pan, the cost is 59s 6d.

Midget Relays

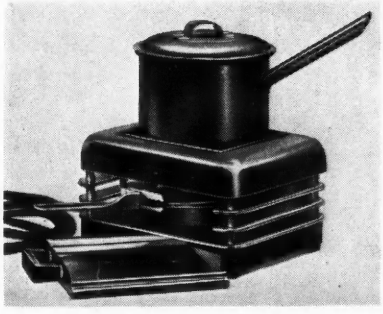
A relay which measures only $1\frac{9}{16}$in by $\frac{7}{8}$in by $1\frac{1}{16}$in and weighs 1.4 oz has been developed by ENGEL & GIBBS, LTD., 983-985, Finchley Road, London, N.W.11. The standard model is of the dust cover type (supplied with or without cover) but a her-

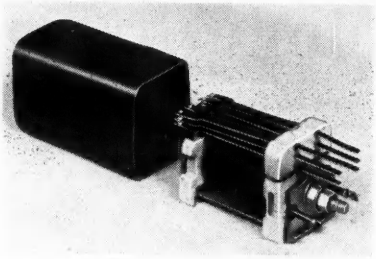


Above: Pig farrowing heater

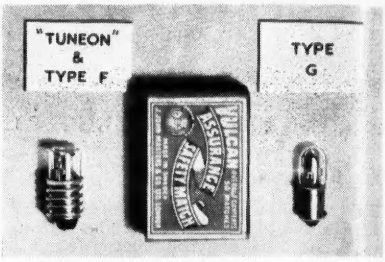
Right: "Mysto" milk saucepan

Below: The "Mastercook"





Dust-cover type midget relay for use on d.c.



The G.E.C. range of miniature neon indicators

metically sealed model is also available $1\frac{3}{4}$in high instead of $1\frac{9}{16}$in and weighing 1.6 oz.

The unit is designed for d.c. operation only and requires approximately 1 W for standard operation. The contact arrangement is normally of the double-pole change-over type. Though designed primarily for low voltage d.c. work, the silver or palladium silver contacts, which are mounted in nickel silver or beryllium copper blades of the two-tongue type, will handle up to 300 mA at 240 a.c. For d.c. work above 50 V an external quenching circuit must be provided. The relay is claimed to withstand a flash test of 2 kV between coil and contact connections.

Due to the use of ceramics for the blade support and coil bobbin, it is possible to employ the relay for radio and high-frequency switching with negligible losses or leakage in the circuit. Aerial switching is a typical application and for very light loads of this type voltages above 240 V can be safely handled. The coil can be wound for direct operation on voltages up to 50 V d.c. but for higher voltages a series resistance is required. The relay is suitable for chassis mounting and single screw fixing is provided, together with a locating stud to facilitate assembly.

Miniature Neon Indicators

A range of three miniature neon indicators has just been placed on the market by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, for use in industry, primarily as visual indicators for live electric circuits.

The small space which they occupy and their negligible current consumption makes them suitable for almost any type of equipment. They are designed to operate from 200/250 V mains, with an external I W resistance of 0.25 to 0.5 MΩ in series.

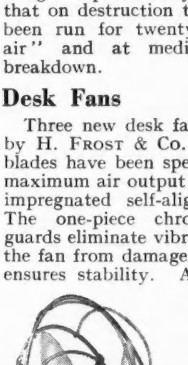
Two of these indicators, types F and G, are for use on a.c., their respective operating currents being 0.5 mA and 0.15 mA, whilst the "Tuneon" type is for use on d.c. and has an operating current of 0.5 mA.

Immersion Heaters

A range of immersion heaters introduced by C. H. BLACKBURN & CO., LTD., 10, Gray's Inn Road, London, W.C.1, are made for voltages from 200 to 250 and with loadings of 1, 2 and 3 kW, although other voltages and wattages can be supplied if required. The length of the rod type element varies from 12in to 30in. The design is particularly robust; it is claimed that on destruction tests the elements have been run for twenty-four hours in "free air" and at medium red heat before breakdown.

Desk Fans

Three new desk fans are being marketed by H. FROST & CO., LTD., Walsall. The blades have been specially designed to give maximum air output and the motor has oil-impregnated self-aligning sleeve bearings. The one-piece chromium-plated resilient guards eliminate vibration noise and protect the fan from damage. A broad heavy base ensures stability. A toggle action switch has been built into the base.



The Frost desk fan

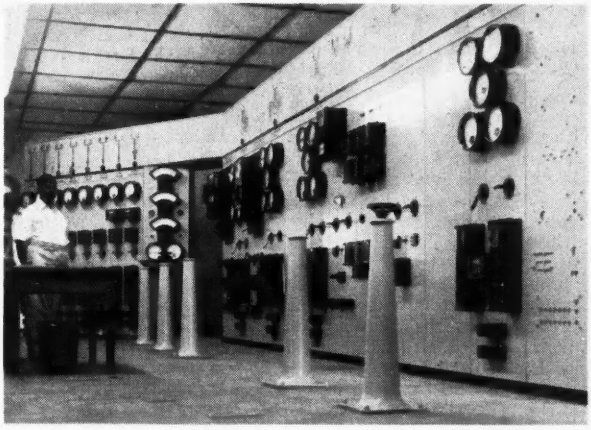
The base and motor are finished in light green enamel relieved with silver. The guards are chromium-plated and the blades have a mirror finish. The 9in non-oscillating type is priced at £3 13s 4d (plus 18s 4d purchase tax in this country). A similar 12in model costs £4 1s 8d (£1 0s 5d purchase tax), and a 12in oscillating type £6 5s (£1 11s 3d purchase tax).

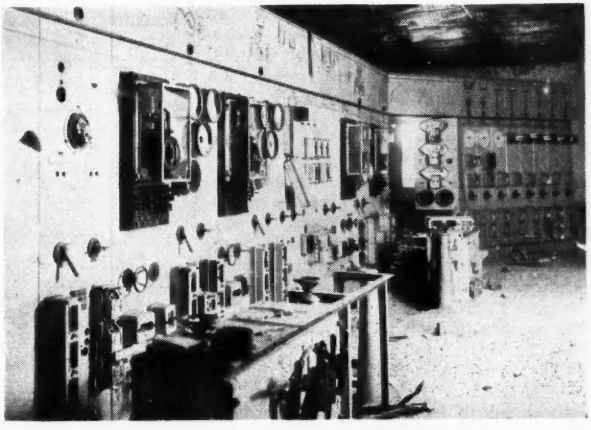
Reconstruction in Burma

New Plant Commissioned at Rangoon Company's Ahlone Station

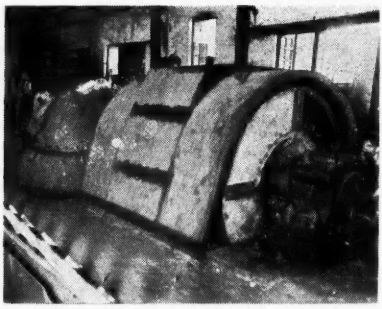
ON 31st January last, His Excellency Saophalong Sao Shwe Thaike, President of the Union of Burma, unveiled a tablet at the Ahlone power station of the Rangoon Electric Tramway & Supply Co., Ltd., on the occasion of the formal commissioning of the first stage, comprising one 60,000 lb/hr boiler and one 10,000 kW turbo-alternator, of the new generating plant which is to replace the plant destroyed during the war.

At the beginning of 1942 the company's plant consisted of five turbo-alternator sets and seven boilers, with a total capacity of 24,000 kW. At the time of the evacuation of Rangoon by the British on 7th March, 1942, the boiler feed pumps were shut down and the stoker grates left running, well covered with coal; the alternator pedestal bearings were simultaneously destroyed with gun-cotton charges while the machines were running at 3,000 r.p.m. With much ingenuity and labour the Japanese endeavoured to repair some of the damage, and were able to give an intermittent partial supply for a while, but at the time that the British reoccupied Rangoon the whole plant was out of operation and beyond repair.





The control room as it is today, showing 6.6 kV Reyrolle switchgear Below: Control board wrecked before the British re-occupation; in front are seen the exciter control panels erected by the Japanese



10,000 kW B.T.H. alternator put out of action in 1942 by the Rangoon Company's staff

The company re-commenced its activities in January, 1946, when it took over two small diesel alternator sets from the Army and subsequently installed two 550 kW and two 2,500 kW turbo-alternator sets of the transportable type, each with its own boiler. These sets are still in operation.

Plans for the reconstruction of the main power station with permanent plant were made in 1945, orders were subsequently placed with Mitchell Engineering, Ltd., for four 60,000 lb/hr boilers, suitable for coal or oil burning, to generate steam at 425 lb/sq in and 750 deg F., together with all auxiliary plant; and with the British Thomson-Houston Co., Ltd., for two 10,000 kW turbo-alternators with Mirrlees Watson condensing and feed heating systems and 400 V power station auxiliary switchgear. In addition a second-hand 6,000 kW turbo-alternator, manufactured by the General Electric Co., Ltd., was purchased from the Borough of Woolwich. The main 6,600 V station switchgear, with a rupturing capacity of 250 MVA, was supplied by A. Reyrolle & Co., Ltd., in 1938. This equipment was partially sabotaged before the re-occupation and the necessary replacement of insulators, instruments and relays was completed in 1946.

The circulating water pump house, situated about 1¼ miles upstream from the power station, was found in fair condition when the British forces returned and after overhaul is again in service. Spray-cooled fresh water ponds having a total capacity of 2,000,000 gallons, with make-up from tube wells, provide circulating water for the four smaller sets. A chlorinating plant has recently been installed for treatment of this water.

The consulting engineers for the new plant are Kennedy & Donkin, London, the civil engineering work, including the new boiler house buildings and the piling of the turbine foundations, having been undertaken by Clark & Greig, Rangoon. The erection of the plant has been carried out under the direction, in the initial stages, of the company's former chief engineer, Mr. G. R. T. Edwards, B.Sc., M.I.E.E. (now Sub-Area manager with the South Wales Electricity Board) and in the latter stages by his successor, Mr. H. T. Moody, A.M.I.E.E. With the exception of three erection engineers provided by the manufacturers of the turbines and boilers, the supervision and labour employed has been drawn from the company's staff, consisting of Britons, Anglo-Indians, Anglo-Burmans, Burmans and Indians.

The erection of the second and third boilers is in an advanced stage and they are expected to be ready for service very shortly. The second turbo-alternator and fourth boiler should be in service in 1951 and 1952, respectively. Space can be made available for a fifth boiler when the existing temporary plant is removed, and the ultimate development may also include a third 10,000 kW turbo-alternator.

The Rangoon Electric Tramway & Supply Co. serves approximately 10,000 consumers in Rangoon and suburbs, an area of some 80 square miles. The present monthly output is about 2,000,000 kWh. Electricity supplies have been severely restricted through lack of generating plant and it is anticipated that the output and number of consumers will be doubled within the next eighteen months.

Clarence River Survey

ACCORDING to a statement issued by the Electricity Authority of New South Wales, surveys of the Northern Rivers area indicate that a dam at the Clarence Gorge would provide storage for hydro-electric plant with an output higher than previously envisaged. Taking the region as a whole, economic development might prove to be between 300,000 and 400,000 kW.

ELECTRICITY SUPPLY

£3,000,000 B.E.A. Contracts

Distribution of "Clow" Surplus

DURING the past month contracts have been placed by the British Electricity Authority for power station, switching and transforming station and transmission equipment amounting in the aggregate to £3,059,879. They include the following:—

Deptford East generating station, h.p. steam and feed piping: John Thompson Water Tube Boilers, Ltd. Brighton "B" station, h.p. pipework: Stewarts & Lloyds, Ltd. Blackburn station, interconnecting pipework and valves: Babcock & Wilcox, Ltd. Huncoat station, Accrington, water treatment plant, and Chadderton station, Oldham, coal handling plant: Simon-Carves, Ltd. Usk Mouth station, Newport, Mon, structural steelwork: Braithwaite & Co. (Structural) Ltd.

Keadby substation, Lincolnshire, 132 kV, 2,500 MVA switchgear: A. Reyrolle & Co., Ltd. Chichester substation, 45 MVA, 132/33 kV transformers and earthing transformers, and Cheltenham substation, 45 MVA, 132/66 kV transformers and earthing transformers: General Electric Co., Ltd. Roosecote substation, Barrow, 132 kV, 2,500 MVA switchgear: Ferguson, Pailin, Ltd. Churchill substation, Somerset, 132 kV, 2,500 MVA switchgear: Metropolitan-Vickers Electrical Co., Ltd. Taunton substation, 132 kV, 2,500 MVA switchgear: British Thomson-Houston Co., Ltd. Ellesmere Port substation, Cheshire, 45 MVA, 132/33 kV transformers and earthing transformers: C. A. Parsons & Co., Ltd.

West Melton-Barnby Moor, 275 kV overhead line: Balfour Beatty & Co. Poplar-Brimsdown, 132 kV overhead line: J. L. Eve Construction Co. Nursling-Fawley and Rye House-Watford, 132 kV overhead lines: W. T. Henley's Telegraph Works Co., Ltd., Braehead-Govan-Hagg's Road, 132 kV, 33 kV and pilot cables: Enfield Cables, Ltd.

Floods in Yorkshire

In the Yorkshire area the floods last month were particularly severe in Tadcaster and district where the flood level was the highest within living memory. The Riverside generating station at Tadcaster was entirely surrounded by water as a result of the overflowing of the River Wharfe. The water turbines ceased to function and the electricity supply was maintained by starting up diesels. Water continued to rise and eventually the diesels were kept in commission only by using additional pumps brought to the station by boat. The good work of the staff under appalling conditions is demonstrated by the fact that, apart from a period of ten minutes when a flash over to earth through wet insulation caused a shut-down, the supply was maintained to all consumers.

"All-Electric" Houses

The *Manchester Evening News* reports that more than 230 Council houses being built on two housing estates at Worsley are to be "all-electric." If estimates at present being sought are approved by the Council electric cookers and wash boilers will be installed in 142 houses on Old Clough Lane site and 88 at Bridgewater Street.

Repayment of Surcharge Surplus

It was announced at a meeting of the Merseyside and North Wales Electricity Consultative Council at Chester last week that the Board proposed to make a temporary reduction of 0.125d per kWh to certain classes of domestic electricity consumers to distribute the surplus which accrued from the surcharge in operation in 1948-49. The chairman, Mr. H. Evans, commented that the Board was honouring its obligations. It had stated that it did not intend the surcharge to increase its revenue and had undertaken to distribute any surplus which might result.

Estate Lighting

Subject to the approval of the Ministry of Health, the Liverpool City Lighting Department is to proceed with the installation of street lighting to serve the eastern portion of the Speke estate at a cost of £9,818.

Herefordshire Supplies

The Malvern Committee of Management of the National Trust has been informed that the abandonment of the Midlands Electricity Board's scheme to take an overhead line across the Malvern Hills will not

prevent an adequate supply of electricity being given to Herefordshire. The Board has acknowledged that there are no technical or practical objections to laying an underground cable. There is an immediate need for more electricity in Herefordshire.

House Installations

Tenders are being invited by Berwick Corporation for the installation of electric lighting in gas-lighted Council houses. The work involves the installation of 1,556 lighting points and 200 5 A socket outlets.

Repair Service

The new repair and maintenance service of the Merseyside and North Wales Electricity Board was discussed and approved by the Electricity Consultative Council at Chester on 1st March. A charge of 4s will be made for faults notified between 8 a.m. and 5 p.m. and 7s between 5 p.m. and 11 p.m., excluding cost of materials. From 11 p.m. to 8 a.m., faults will be charged for on the basis of actual cost, including transport.

Pole Erection

As an experiment a pole hole excavator was used recently in the Eastern Board's Norfolk Sub-Area in connection with the erection of the Witton 11 kV overhead line and was found to be most satisfactory. The hole was excavated and the pole erected in 10 minutes compared with the normal five hours by manual methods. Data of similar work elsewhere is being collected by the chief engineer's department.

Domestic Consumers and Peak Load

ADDRESSING the South Western Regional Board for Industry at Bristol on Tuesday, Mr. S. F. Steward, C.B.E., chairman of the South Western Electricity Board, in the course of a discussion on industrial load spreading arrangements for next winter, said it was a misconception that domestic consumption was solely responsible for the problem of the "peak" hours during the winter months. In the South West it was only in Bristol, where there was a large industrial load, that the peak occurred at the critical time of 8 to 8.30 a.m. In other parts of the Area, where domestic load predominated, the time of the peak varied; in the Taunton and Exeter Sub-Areas, for example, the peak was from 12 to 12.30 p.m., when there was very little industrial demand.

Most domestic appliances, including cookers, had only a small effect on the peak load, and it had been estimated that the addition of 100,000 electric cookers would add less than ½ per cent to the national morning peak. Furthermore, the encouragement of additional domestic load would in general improve the load factor, and would thus benefit all consumers, including industry.

At the time of national peak 40 per cent of the load was taken by industry compared with about 30 per cent each for the domestic and commercial loads. Cold weather gave rise to additional demand not only for domestic space heating, but also for many other purposes including additional industrial power when starting up from cold.

Dealing with the particular problem of the South Western Electricity Board, Mr. Steward said that the vital need was to improve the earning power of the Board's assets; the main scope for this was among domestic consumers. As a matter of policy, the Board was giving no encouragement to the sale of electric fires because of their contribution to the peak load problem. Replying to a suggestion that a 1 kW radiator if switched on at peak periods cost the nation £100, Mr. Steward said that figures obtained in the extremely cold weather of January, 1947, in respect of an estate of some 100 prefabricated houses showed that the average demand per house at the time of the system peak load was only 0.57 kW, in spite of the fact that these houses were fully supplied with electrical appliances as part of their standard equipment and nearly 70 per cent had installed additional electric radiators.

Commenting on a suggestion that domestic consumers should be diverted from electricity to gas, Mr. Steward said that the peak load problems of the gas industry were in their own way as great as those of electricity supply. Furthermore, the coal used by electric power stations was of a very inferior quality unsuitable for export, while gas coking coal would have a ready export market.

Mr. Steward also stressed the importance of preserving the right of the consumer to choose his own fuel. He believed that free and fair competition between gas and electricity was the way to maintain a high level of efficiency and service to the consumer. Economic considerations alone would prevent unsound competition with gas for the space heating load.

Simplified Motor Construction

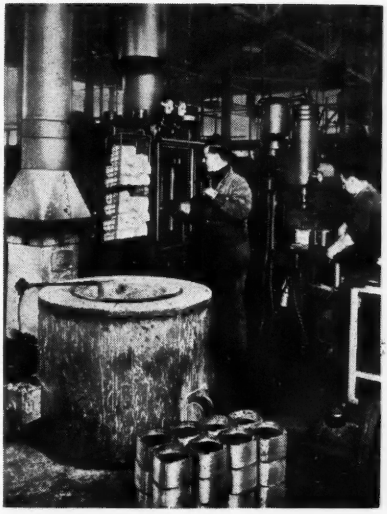
Re-design of Hoover Fractional-h.p. Units

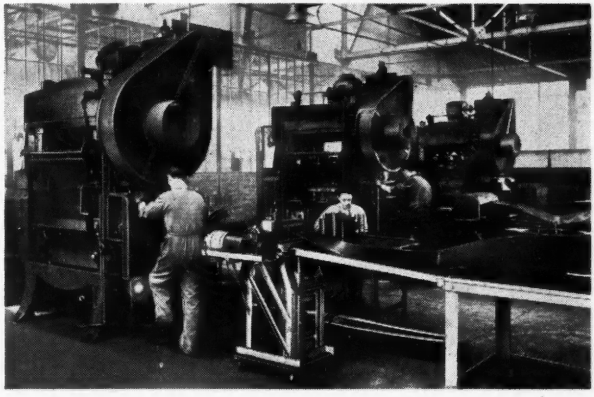
AT its works at Cambuslang, Scotland, Hoover (Electric Motors), Ltd., has now discontinued the manufacture of the range of induction motors which it started to produce in 1945 and has changed over to an entirely new design which, besides being much simpler to make, has a number of desirable operational features.

The principal departure from conventional practice is the die-casting of the laminations into the stator and rotor units, the end frames also being die-cast. The laminations are stamped out by presses, feeding of the sheet metal being controlled by selenium cells. The feed rollers are arranged to work faster than the press and are stopped and started according to whether or not there is sufficient metal sagging down between the rollers and the press to prevent horizontal beams of light from striking the selenium cells. After sorting, the laminations are taken by conveyor to a new die-casting shop, the equipment of which includes both horizontal units and a new type of Daniels vertical die-casting machine.

Besides eliminating the riveting of the stacks of laminations, the new method does away with a considerable amount of turning and grinding. The rotors are die-cast complete with fans, and the windshield is now an integral part of the endshield instead of being built in. Drilling and turning of the end frames is now carried out in one operation on "Rydermatic" machines instead of ten by the old methods.

Two different methods of winding the stators have been adopted—skein and

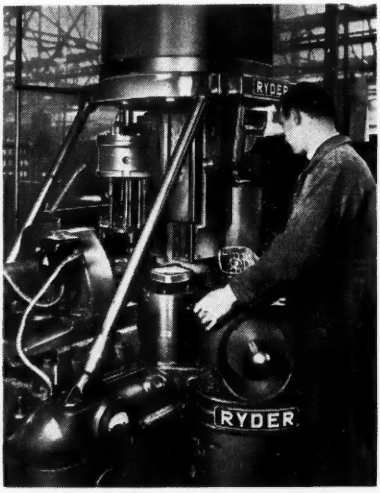




Top right: Die-casting the stator housing around the laminations

Right: The feed to the press stamping out the stator and rotor laminations is controlled by photo-electric cells

former. The skein method is employed for 2-pole and 6-pole types of motor, and former winding for all other types. For the skein winding pairs of coils are wound simultaneously on machines designed and made in the works. Synthetic resin-covered wire is employed. A continuous impregnation plant has been installed for treating the stators and rotors after winding. Dynamic balancing of the rotors is carried on a "Gisholt" electronic device, and among other testing equipment is special apparatus for checking the operating speed of the centrifugal switch.



Turning and drilling of end frames is carried out in one operation on "Rydermatics"

One of the most important operational features of the new motor is the ventilation. Tunnels of large proportions with extensive surface area are incorporated in the corners of the die-cast stator, thus exposing the periphery of the laminations to the air flow. In addition the exact register and liberal surface contact of the aluminium die-cast end frames ensure good conduction of heat to the outside surface. The motor, which complies with Refrigeration Appendix D to B.S. 170/39, is normally designed for a 40 deg C temperature rise.

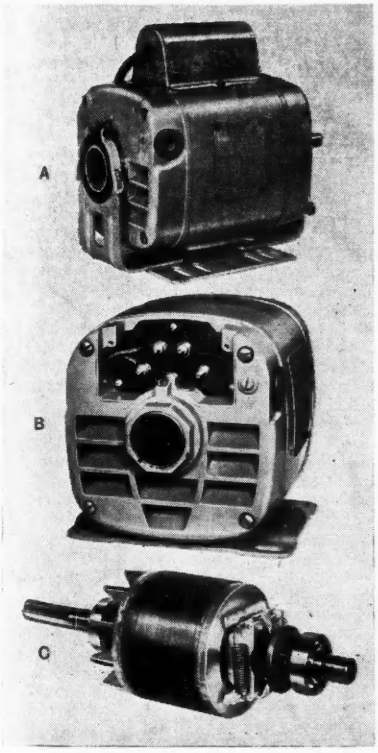
Risk of damage to the bearings when removing the end frames for servicing has been reduced by making the shaft extension smaller in diameter than the journal. The terminal board is accessible and a thermal overload cut-out is available for single-phase motors with either automatic or manual resetting device. This cut-out, which is of Hoover design and manufacture and is current and temperature sensitive, is mounted in close proximity to the overhang of the windings. The centrifugal switch has been re-designed with fewer moving parts than its predecessor.

Although the new motor is considerably lighter than the old model—a ½ h.p. model, for instance, weighs 22½lb compared with 25lb—it is equally robust, and in certain respects the motor is stronger. For example, by suitably proportioning the die-cast housing, the end frames have been kept shallow, with consequent increase in strength and rigidity.

Batches of new and old types of motors in the Test Department of the Cambuslang works

One common source of trouble has been eliminated by so designing the protective housing of the electrolytic capacitor, when fitted,

Above: Inserting former wound coils in stator Below: (A) Capacitor start motor; (B) Shows terminal box recessed in end frame of drip-proof motor; Rotor for ball bearing motor showing mechanism of starting switch



as to make it impossible to pick up the motor by the capacitor. An overflow device has been fitted so that in the event of gross over-oiling surplus oil will drain externally instead of into the motor. Resilient mounting, with an automatic belt-tensioning device, and the use of a large diameter (⅞in) shaft with ball or sleeve bearings contribute to the exceptionally quiet running of the motor.

The absence of sheet-metal components makes the motor particularly suitable for use overseas. For most parts of the world the standard models can be safely used, but where extreme climatic conditions are likely to be encountered, double impregnation of the windings and special treatment of the other components can be undertaken. The normal finish employed is quite suitable as it is, but it also provides a receptive surface for a final finish by the customer if he so desires.

Single-phase units are available in all standard voltage ranges and three-phase types are made for 300/400 V, 400/440 V and 220/380 V (star delta). Although the normal frequency is 50 cycles, models can be supplied for 40 or 60 cycles. The standard motor is drip-proof, but total enclosure can be provided if required. Flange-mounting models are also available. Motors are normally supplied with a ⅞in orifice tapped for conduit on the right-hand side viewed from the terminal-box end, but they are also fitted with flexible rubber bushes for use when conduit is not utilized.

With the change-over to the new motor, the factory has installed a completely separate production section for the manufacture of all the special-type motors used in Hoover electric washing machines.

In addition to the establishment of the new die-casting shop referred to, an extension, representing a 25 per cent increase in the production area available at the factory, has recently been completed, and the whole layout of the works has been reorganized to secure the necessary increased output.

Drying Haddocks

The Eastern Electricity Board (Essex Sub-Area) has recently installed for a consumer a 12 kW duct air heater embodying a 1,400 r.p.m. fan for drying haddocks.

Magnetic Amplifiers

Fundamental Limitations and a New Theory

IN the field of electrical measurements and in many industrial control devices and servomechanisms it is becoming increasingly necessary to employ some means of amplifying very small signal voltages of either d.c. or low frequency a.c. For this purpose the magnetic amplifier has many advantages over its valve-operated counterpart and it is therefore not surprising that considerable interest was displayed in two papers on the subject which were read in London on Tuesday at a joint meeting of the Measurements and Radio Sections of the Institution of Electrical Engineers.

Second-Harmonic Modulators

In the first of these Professor F. C. Williams (University of Manchester) and Mr. S. W. Noble (Telecommunications Research Establishment, Ministry of Supply) deal with the fundamental limitations of the second-harmonic type of magnetic modulator as applied to the amplification of small d.c. signals. They point out in the introduction that flicker noise and zero drift are among the most notable factors which determine the smallest signal voltage that can be satisfactorily amplified by a valve-operated d.c. amplifier. Where stability and accuracy are essential this presents a serious handicap, but better results can often be obtained by using a suitable modulator to convert the d.c. to a.c. followed by an a.c. amplifier and rectifier.

The advantages of the second-harmonic type of magnetic modulator for this purpose are discussed and the paper presents a theoretical analysis of an idealized version of the device, with particular reference to the influence of various controllable parameters on the signal/noise ratio and zero error.

The paper then proceeds to describe experimental work, which, with allowance for the idealizations in the theoretical analysis, is considered to provide a satisfactory qualitative verification of the latter. Particular emphasis is laid on the need for great care in the design of the various circuits to eliminate additional sources of noise and zero error. It is believed that the noise output of the apparatus described is due mainly to Barkhausen effect which is equivalent to a signal input of about 10^{-19} W. The zero drift, however, is considerably greater than this, being equivalent to a signal input of about 3×10^{-18} W over a two-hour period.

From the conclusions reached it seems that a useful d.c. amplifier for small signals can be based on the magnetic modulator, particularly when the signals are derived from a low impedance source, such as a thermo-junction. Such an instrument has already been developed and a description is in course of preparation.

Theory Based on Idealized Form

The second paper to be read was prepared by Mr. A. G. Milnes (Royal Aircraft Establishment, but temporarily at the University of Bristol). It presents a completely new theory of the magnetic amplifier with a finite load resistance and low-impedance signal source. The analysis assumes that the B/H curve for the core material has a constant initial slope, followed by an abrupt transition to zero slope at the saturation level.

From this basic assumption, flux waveforms are derived and equations are developed for the magnetomotive forces operating at every instant in the cycle for a transductor with any degree of self-excitation. From these results analytical expressions are derived for the output characteristics and the particular conditions of zero and full self-excitation are examined in detail. Further expressions, both in full and in simplified form, are obtained for the current amplification and time-constant of a transductor, since these quantities are of considerable importance in design work.

Because of the idealized form assumed for the B/H curve, the theoretical characteristics are not completely realized in practice. The theory does, however, provide a basis for improved methods of design and explains certain important phenomena, such as the variations of the current amplification with change of load resistance, which are not revealed by more elementary treatments of the subject.

Ex-British Westinghouse Association.—The annual dinner will be held on 17th March at the Connaught Rooms, W.C.2. Tickets can be obtained from Mr. W. D. Taylor, St. Paul's Corner, 1, St. Paul's Churchyard, London, E.C.4.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

REPORTS AND DIVIDENDS

Taylor, Tunnicliff (Electrical Industries), Ltd., reports a consolidated trading profit, etc., for the year ended 31st December last of £324,533, as compared with £281,346 for the preceding year, and after providing for depreciation, taxation, directors' remuneration, etc., there is a net profit of £123,428 (against £85,125), to which is added £189,924 brought in, making £313,352 available. The ordinary dividend for the year is maintained at 15 per cent, and £255,845 is carried forward.

In his statement circulated with the report and accounts, Col. W. J. Kent (chairman) says that the volume of turnover of the various companies has reached a new high level during the year under review. There has been a continued demand for all their products, and in particular for the insulators used in h.v. transmission lines, switchgear and transformers. They have pushed ahead rapidly with the scheme of expansion at their Stone works; at Longton the first stage of reconstruction of the works has been completed and Government permission has been obtained to commence the second stage.

The Brush Electrical Engineering Co., Ltd., reports a group trading profit for the year ended 31st December last of £1,917,992, as compared with £1,312,091 for 1948, and after deducting depreciation and interest, a net profit, subject to taxation, of £1,307,485 (against £868,467), to which is added previous year's profits adjustments of £39,496, making £1,346,981. Taxation requires £693,103 (against £248,783), leaving a net profit of £653,878 (£651,510). General reserve receives £500,000, and it is proposed to pay a final ordinary dividend of 6 per cent, again making 10 per cent for the year. The balance carried forward is £54,278 (against £18,650 brought in).

A. H. Hunt, Ltd., report a net profit for 1949 of £22,564 (as compared with £30,064 for the period 21st December, 1947, to 31st December, 1948). After providing £7,000 for future income tax, it is proposed to pay a final dividend of 15 per cent, maintaining the distribution for the year at 22½ per cent. The balance carried forward is £15,168 (against £15,073 brought in).

The Midland Electric Manufacturing Co., Ltd., reports a trading profit for 1949 of £287,959, as compared with £287,585 for the preceding year, and a net profit of £117,891 (against £115,739). It is proposed to pay a dividend for the year of 12½ per cent, less tax, on the ordinary capital as increased by a 200 per cent bonus issue last July. The distribution for the previous year was 35 per cent.

Hoover, Ltd., reports a consolidated trading profit for 1949 of £1,719,378, as compared with £829,072 for 1948. Tax on consolidated profits is £870,249. The profit available to the parent company is £692,147, an increase of £284,663. The final dividend on the ordinary stock is 35 per cent, actual, making 45 per cent for the year. For the previous year, the final dividend was 20 per cent, plus a cash bonus of 10 per cent, making 40 per cent, less tax, for the year.

Heenan & Froude, Ltd., are paying an unchanged interim dividend of 5 per cent.

A. F. Bulgin & Co., Ltd., are paying a dividend for the year of 25 per cent (against 27½ per cent for a period of one year and 12 days to 31st January, 1949).

Crabtree Electrical Industries, Ltd., has declared an unchanged interim dividend of 5 per cent.

Murex, Ltd., has declared an interim ordinary dividend of 4 per cent, less tax. This compares with 7½ per cent for 1948-49, but is payable on capital increased by a 100 per cent bonus, which was announced after last year's 12½ per cent final dividend which made 20 per cent, less tax.

E. K. Cole, Ltd., have declared an interim dividend on the ordinary stock of 8 per cent, less tax. For the eighteen months ended 31st March, 1949, the total was 30 per cent, which consisted of an interim dividend of 6 per cent, a second interim of 9 per cent, and a final of 15 per cent.

Brown Brothers, Ltd., have announced a final dividend of 7½ per cent, making 10 per cent, less tax, for the year, on ordinary capital increased by a scrip bonus of 100 per cent. A total dividend of 20 per cent was paid on the old capital for 1948. The net profit for 1949 is £159,241.

The Lancashire Dynamo and Crypto, Ltd., has announced a second interim dividend and bonus of 17½ per cent, making 22½ per cent for the year (unchanged). No further dividend for 1949 is proposed.

NEW COMPANIES

Reay Electrical (Stockton), Ltd.—Registered 1st March. Capital £1,000. Directors: J. K. Reay and J. L. Reay. Regd. office: West Row, Stockton-on-Tees.

N.F.P. Electrical Installations, Ltd.—Registered 1st March. Capital £1,000. To acquire the business of electrical heating, lighting, power, refrigeration, radio and television engineers, contractors, wholesalers and retailers, dealers and mechanics, carried on by G. J. Nicholls and D. A. Poole at 20, Pimlico Road, S.W. Directors: G. J. Nicholls, D. A. Poole and E. J. Farley. Regd. office: 49, Queen Victoria Street, E.C.4.

Creemer's Radio and Electrical, Ltd.—Registered 1st March. Capital £5,000. Directors: J. W. Creemer and B. H. Gerrish. Regd. office: 93, Albany Road, Cardiff.

M. Preston & Co. (Electrical Manufacturers), Ltd.—Registered 20th February. Capital £100. Subscribers: M. Preston and R. W. Harris. Regd. office: 15, Soho Square, W.1.

Sanderson Auto Engineering Co., Ltd.—Registered 17th February. Capital £1,000. Manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: H. J. Anderson, W. Cheal, A. C. Baker, F. Hodgkinson and A. H. Monk. Regd. office: 12, Frederick Place, Brighton.

Wilcox Organization, Ltd.—Registered 22nd February. Capital £2,500. Mechanical, general and electrical engineers and contractors, television and radio engineers, etc. Directors: H. W. Wilcox and S. G. Wilcox. Regd. office: 4, Earlham Street, Cambridge Circus, W.C.2.

L. A. Barnes (Import & Export), Ltd.—Registered 24th February. Capital £1,500. Manufacturers of and dealers in electrical accumulators, batteries, acids and containers, dynamos, motors, etc. Subscribers: Margaret E. Franklin, 90, Overdale, Ashtead, Surrey, and G. N. Salway.

C. Mickleburgh (Retail), Ltd.—Registered 23rd February. Capital £1,000. Dealers in electrical apparatus of all kinds, etc. Directors: C. W. Edwards and I. F. Edwards. Reg. office: 436, Harrow Road, Paddington, W.9.

Fenton's (Electrical), Ltd.—Registered 24th February. Capital £7,000. To acquire the business of electrical and radio engineering, contracting and retailing, etc., carried on by G. N. Fenton at Colwyn Bay and Rhos-on-Sea. Directors: G. N. Fenton, T. H. Williams, L. Fenton and F. Thompson. Regd. office: 19, Conway Road, Colwyn Bay.

INCREASES OF CAPITAL

English Electric Co., Ltd.—Increased by £1,500,000, in £1 ordinary shares, beyond the registered capital of £6,500,000.

WINDING-UP PETITION

Ward Electrical Engineering Co., Ltd.—A petition for the winding-up of this company has been presented to the High Court by Falk, Stadelmann & Co., Ltd., and will be heard in London on 13th March.

LIQUIDATIONS

Mayfield Electrics, Ltd., electrical engineers and contractors, 7, Station Parade, Virginia Water, Surrey.—A meeting of creditors was held recently when a statement of affairs was submitted which showed liabilities amounting to £6,038, and net assets of £778, leaving a deficiency as regard the creditors of £5,259. The issued capital of the company amounted to £652 and, so far as the shareholders were concerned, there was a total deficiency of £5,911. A resolution was passed confirming the voluntary liquidation of the company with Mr. H. P. Carter, C.A., of 8, Breams Buildings, London, E.C.4, as liquidator, together with a committee of inspection.

Vialux, Ltd.—Winding up voluntarily. Liquidator, Mr. T. D. Walker, 23, Blomfield Street, London, E.C.2. Particulars of claims to the liquidator by 21st March.

Dawes Radio & Electric, Ltd.—Particulars of claims to the liquidator, Mr. A. H. Edwards, 22, High East Street, Dorchester, by 15th March. This notice is purely formal, as all creditors have been or will be paid in full.

BANKRUPTCIES

M. R. Horne, carrying on business at 491, Alum Rock Road, Birmingham, as Malcolm & Stewart, wireless and electrical retailer.—Supplemental dividend of 8d in the £1, payable 27th March at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

G. L. Barber, 19, St. Alban Street, Weymouth, Dorset, electrical contractor and radio engineer.—First and final dividend of 4s in the £, payable 13th March at 22, High East Street, Dorchester.

S. Cooper, 17, St. Margaret's Road, St. Marychurch, Torquay, electrical engineer.—First meeting 10th March at the Official Receiver's office, 26, Baldwin Street, Bristol. Public examination 25th April at Castle Chambers, Higher Union Street, Torquay.

FINANCIAL SECTION

STOCKS and SHARES

THE dust of the General Election having settled down, business in the Stock Exchange, as elsewhere, is assumed to be running in a more normal manner. So far as the House is concerned, however, it must be said that markets are not much more active now than they were two or three weeks prior to the election. Suspense and uncertainty are the two worst enemies of Stock Exchange business. Both are now present in force, and it is only natural that prices, when they move at all, go down. The King's Speech at the opening of Parliament had little effect upon Stock Exchange prices. The fact that nationalization was not mentioned in the speech led to a little buying of cement shares, Imperial Tobacco and Imperial Chemicals. Gilt-edged stocks hardly moved.

English Electric Accounts

Profits of the English Electric group for 1949 are shown in the full accounts at £700,000 after tax. In the previous year they were under £600,000. They have been dealt with on conservative lines. Allowing for the preference dividend, the 10 per cent distribution on the ordinary shares takes less than one-third of the balance on profit and loss account. Reserves have been fortified by more than a million, and are now not far short of the total issued capital. The overdrafts will have been largely dealt with, since the close of the year, by the £3.9 million raised in this year's debenture and share issues. Stocks and work in progress stand at much higher figures, and the capital expenditure programme is practically completed. The yield of £4 17s 6d per cent on the £1 shares at 41s is considered a very fair return.

Hoover's Records

Hoover's provisional results for 1949 show group trading profits at the record level of £1.7 million—more than double the previous year's figure. By comparison they give a modest appearance to the increase in the total ordinary dividend from 40 per cent (on £800,000 capital) to 45 per cent (on £935,000). A statement on dividend policy is to be given with the chairman's annual review. After hardening to 38s 9d, the 5s shares pay £5 16s 3d per cent on the money.

Another good profits statement is that of Taylor Tunnicliff Industries, whose 5s shares stand at 13s 3d to yield £5 13s 3d per cent on the dividend maintained at 15 per cent. The £1 shares of Westinghouse Brake are quoted at 58s 6d, and return £4 15s 9d per cent on the 14 per cent payment, which is shown by the full accounts to be covered by earnings of about 34 per cent.

Brush Electrical Engineering

This company completed its big deal for the acquisition of three of the Associated British Engineering subsidiaries just over a year ago, and now reports for 1949 a 46 per cent increase in the group's trading profit, to close on £2 million. Higher tax provisions leave the net profit little changed, but it covers the 10 per cent ordinary dividend more than six times over and enables the directors to add half-a-million to reserves. The results have revived market discussion about the possibility of an issue to replace the heavy overdrafts on which the group's expansion has been partly financed, and for which a more permanent form of borrowing was originally intended. At 6s the quotation for the 5s ordinary shares is midway between last year's extremes of 7s 3d and 4s 9d. The yield works out at 8¼ per cent.

The Week's Changes

Aberdare Cables at 66s 3d are 6s 3d up since a week ago. Other improvements include Hoover, 1s 9d better at 38s 9d; Johnson & Phillips, 61s 3d, Ever Ready, 31s 3d, Associated Electrical 70s, Falk Stadelmann 37s 6d, all being $\frac{1}{16}$ to the good. On the other hand, Tube Investments at 5½ are 5s down. General Cable, 16s 3d, have lost $\frac{1}{16}$, and smaller falls occurred in Calcutta Electric, 21s, Cossor, 8s. 3d, Babcock, 67s and E.M.I., 20s.

Dividends Declared

No particular significance was credited to the fractional increase represented by the Murex interim dividend of 4 per cent on the recently doubled capital: it compares with last year's 7½ per cent, equivalent to 3¾ per cent on the present amount of ordinary stock. Holders were advised not to draw dividend inferences when the capital bonus was made. On a 10 per cent basis the shares at 47s 6d. yield 4 guineas per cent. E. K. Cole's 8 per cent interim reverts to the rate paid since 1944, but interrupted last year by the extension of the accounting period over 18 months. The 30 per cent paid for that period was at the rate of 20 per cent per annum, which gives the 5s shares, at 16s 6d, a yield of just over 6 per cent. A. F. Bulgin 1s shares are quoted at 2s 7½d to yield 9½ per cent on the 25 per cent dividend just declared.

NEXT WEEK'S EVENTS

Monday, 13th March

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.E. South Midland Supply and Utilization Group. "Technical Considerations Affecting the Development and Design of Electrical Control Gear for Machine Tools," by A. R. H. Thorne.

LEEDS.—Lighting Service Bureau, 24, Aire Street, 6 p.m. I.E.S. Leeds Centre. "Railway Light Signalling Systems," by G. G. F. Halliwell.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. "The Electronic Performance of Simple Mathematical Processes," by R. C. Orford.

Café Royal, Regent Street, W.1, 6 for 6.30 p.m. Batti-Wallahs' Society. Annual ladies' night dinner and dance.

Connaught Rooms, Gt. Queen Street, W.C.2. Incorporated Sales Managers' Association. Conference on "Sales Planning for Dollar Markets." (Continued on 14th March.)

NEWCASTLE-ON-TYNE.—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "The Automatic Control of Lead-Acid-Battery Charging Equipment," by R. A. Harvey.

Tuesday, 14th March

BELFAST.—Queen's University, 6.45 p.m. I.E.E. Northern Ireland Centre. "The Testing, Reconditioning and Servicing of Domestic Appliances," by H. Hobbins.

COVENTRY.—East Midlands Electricity Board Demonstration Room, Corporation Street, 7 p.m. E.P.E.A. Midland Technical Group. "Rural Electrification," by P. W. Cave.

LEEDS.—Y.E.B. offices, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "The Motor Uniselector and the Technique of its Application in Telecommunication," by W. H. Grinsted.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. "A New Approach to the Design of Pulse-Monitored Servo Systems," by Dr. A. Porter and F. W. Stoneman.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Acrylic Mouldings for Flameproof Mine Lighting Fittings," by W. E. Harper and P. H. Collins.

MANCHESTER.—Midland Hotel, 7.15 p.m. I.E.E. North-Western Centre. Annual dinner and visit of president.

RUGBY.—Electricity Showrooms, High Street, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Some Electromagnetic Problems," by Prof. G. W. O. Howe (joint meeting with Students' Section).

WIMBLEDON.—Compton Hall, Compton Road, S.W.19, 8.15 p.m. A.S.E.E. South-West London Branch. "Single Phase Induction Motors," by A. N. D. Kerr.

Wednesday, 15th March

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "Selection of Transformers for Use in Distribution Networks, with special reference to the New Low-Voltage Standard of 240 V," by E. Tobin.

LIVERPOOL.—The Temple, Dale Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "The Nature of the Electric Spark," by Prof. J. M. Meek. (Joint meeting with the Liverpool Engineering Society.)

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. Lecture on "The Structure, Electrical Properties and Applications of the Barium-Titanate Class of Ceramic Materials," by Prof. Willis Jackson.

I.E.E. London Students' Section, 2.30 p.m. Visit to E.R.A., Greenford, Middx.

MAIDSTONE.—New Inn, Sandling Road, 7.30 p.m. I.E.E. District meeting. Two short talks. "Industrial and Fluorescent Lighting," by T. Catten and "Public and Flood Lighting," by H. E. G. Watts.

MALVERN.—Warwick House Restaurant, 7.15 p.m. I.E.E. South Midland Radio Group. "Some Electromagnetic Problems," by Prof. G. W. O. Howe.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. Discussion on "Space Heating," opened by F. D. Wild and H. Fairbanks.

SHEFFIELD.—Grand Hotel, 6.15 p.m. I.E.E. Sheffield Sub-Centre. "The Testing, Reconditioning and Servicing of Domestic Appliances," by H. Hobbins.

TAUNTON.—Electric House, 3 p.m. I.E.E. South-Western Sub-Centre. "The Phase/Neutral System of Supply for Rural H.V. Distribution," by G. T. Garwood and G. J. Websdale.

Thursday, 16th March

BRADFORD.—Y.E.B. offices, 45-53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Lighting of Recreation Centres," by A. Wilcock.

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Thoughts on the Earthing of Consumers' Equipment," by J. O'Farrell.

LONDON.—Savoy Place, London, W.C.2, 5.30 p.m. I.E.E. Extra Meeting. "The Continental Development of Single-Anode Mercury-Arc-Rectifier Valves for High Power." H. Von Bertele.

Friday, 17th March

HARROGATE.—Grand Hotel, 7.30 for 8 p.m. I.E.E. North Midland Centre. Annual dinner and dance.

SOUTHSEA.—Royal Beach Hotel, 6.30 for 7 p.m. I.E.E. Southern Centre. Annual dinner and dance.

Saturday, 18th March

HUDDERSFIELD.—Y.E.B. offices, Market Street, 2.30 p.m. I.E.E. North Midland Students' Section. Sheffield Exchange Paper, "The D.C. Traction Motor," by S. A. Wood.

EXHIBITIONS

6th-25th March

MANCHESTER.—Central Library. Institution of Electrical Engineers, North-Western Centre. Jubilee exhibition.

7th March to 1st April

LONDON.—Olympia. *Daily Mail* Ideal Home Exhibition.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1944

4[illegible]5. British Thomson-Houston Co., Ltd.—Apparatus for converting recorded sound waves to frequency modulated currents. 7th March, 1944. (636101.)

1945

16539. Sperry Gyroscope Co., Inc.—Radio receiving systems and radio scanning and switching or modulating devices for controlling radio energy. 24th April, 1945. (636105.)

16703. British Thomson-Houston Co., Ltd.—Phase sensitive modulators. 31st May, 1945. (636103.)

15185. Stevens, A. H. (Submarine Signal Co.).—Electrical beam sweeping apparatus for directive transducers. 14th June, 1945. (Convention date not granted.) (636313.)

21556. British Thomson-Houston Co., Ltd.—Washing machines. 23rd August, 1945. (636104.)

23981. Sadir-Carpentier.—Navigation aiding radio systems. 17th September, 1945. (636316.)

32763. British Thomson-Houston Co., Ltd.—Phase-shifting transformer connections. 4th December, 1945. (636317.)

1946

3783. Triggs, W. W. (Farnsworth Television & Radio Corporation). — Electron-discharge tube for differentiating an input signal. 6th February, 1946. (636107.)

7144. British Thomson-Houston Co., Ltd.—Cathodes for electric-discharge devices. 7th March, 1946. (636383.)

17639. Bendix Aviation Corporation. — Electronic timer. 12th June, 1946. (636113.)

19884. Purdue Research Foundation.—Alloys and rectifiers made thereof. 3rd July, 1946. (636248.)

20030. Purdue Research Foundation.—Asymmetrically conducting electrical devices. 4th July, 1946. (636249.)

23287. Telefonaktiebolaget L. M. Ericsson.—Mains-operated vacuum tube device for measuring or amplifying direct or low-frequency alternating-current. 6th August, 1946. (636179.)

23359. Radio Corporation of America.—Television and like pick-up tubes. 6th August, 1946. (636250.)

23899. Decca Record Co., Ltd., Wayne Kerr Laboratories, Ltd., Calvert, R., Fennessy, E., and Roberts, G. E.—Devices for use in the navigation of a mobile vehicle. 12th August, 1947. (Cognate applications 27085, 9th September, 1946, and 29708, 4th October, 1946.) (636180.)

29660. Standard Telephones & Cables, Ltd.—Pulse receiving and repeating systems for telecommunication networks. 4th October, 1946. (636253.)

31901. Okonite Co.—Apparatus for detecting faults in the insulating covering of an electric wire or cable. 28th October, 1946. (636119.)

31919. Soc. Industrielle des Procedes Loth.—System for locating a receiving station with respect to a transmitting station. 28th October, 1946. (636185.)

33124. Schreuer, W.—Power oscillators for the production of high-frequency currents. 7th November, 1947. (636254.)

34548/9. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Moving-coil measuring instruments. 21st November, 1946. (636121 and 636255.)

37126. British Thomson-Houston Co., Ltd.—Gyroscope erecting devices. 17th December, 1946. (636123.)

37538. British Thomson-Houston Co., Ltd.—Phonograph pick-ups. 20th December, 1946. (636190.)

38048. British Thomson-Houston Co., Ltd.—Current transformers. 30th December, 1946. (636192.)

1947

2270. Philips Lamps, Ltd.—Discharge-tubes for use in tuning-indicators. 24th January, 1947. (636125.)

2395. Sandberg, S., and Lindblom, K. J.—Supporting means for electrical overhead conductors. 25th January, 1947. (636197.)

4820. Philips Lamps, Ltd.—Radio direction finding devices. 19th February, 1947. (636199.)

5725. Stivin, J.—Ferro-magnetic cores for high-frequency machines and apparatus. 27th February, 1947. (636127.)

7308. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Photo-electric cell systems with remote amplifiers. 17th March, 1947. (636128.)

7852. Aron Electricity Meter, Ltd., and Riordan, E. J.—Alternating-current electrical instruments and electromagnets therefor. 22nd March, 1948. (636129.)

8831. Hazeltine Corporation.—Radio wave-signal transmitting system. 1st April, 1947. (636208.)

9333. Trist & Co., Ltd., R., and Chambers, W. A.—Electrically actuated detection or warning systems. 5th April, 1948. (636341.)

9957. Campbell & Isherwood, Ltd., and Meredith, J.—Overload release devices. 13th April, 1948. (636404.)

9999. English Electric Co., Ltd., Mitchell, H. W., and Bent, R. A.—Systems of electric motor control. 14th May, 1948. (636210.)

10695. Morton, C.—Amplifiers for voltages or currents of zero or low frequency. 3rd February, 1948. (636212.)

11976. Miles Aircraft, Ltd., Hunt, C. L., and Hawkins, A. S.—Snap-action electric switches. 5th October, 1945. (Divided out of 636171.) (636216.)

12072. Westinghouse Electric International Co.—Drives for moving stairways. 5th May, 1947. (636133.)

14165. British Rawhide Belting Co., Ltd., and Dibovsky, V. V. — Electrically driven reciprocating tools. 17th June, 1948. (636406.)

15828. Scophony, Ltd., and Wikkenhauser, G.—Radar plan position indicators. 12th July, 1948. (636408.)

16226. Masson, E. P.—Electric time recording or time signalling apparatus. 19th June, 1947. (636136.)

16344. Standard Telephones & Cables, Ltd.—Electric pulse time modulation systems of communication. 20th June, 1947. (636409.)

16393. Scintilla Akt.-Ges.—Electric starters for internal-combustion engines. 20th June, 1947. (636224.)

17714. General Electric Co., Ltd., and Collyer, J. E.—Telephone systems. 23rd March, 1948. (636138.)

17716. Elliott Bros. (London), Ltd., and Pizzey, C. F.—Electrical measuring apparatus. 30th June, 1948. (636410.)

18081. British Electronic Products, Ltd., and Bent, R. A.—Protective devices for three-phase electric apparatus. 30th October, 1947. (636411.)

18159. Standard Telephones & Cables, Ltd., and Holland, J. D. — Coupled circuits. 9th July, 1948. (636220.)

20934. Electrolux, Ltd. — Vacuum cleaners. 1st August, 1947. (636415.)

21032. Sperry Gyroscope Co., Inc.—Electric timing circuits. 1st August, 1947. (636416.)

21355. Steatite & Porcelain Products, Ltd., Woodcock, J., and Paridge, J. K.—Ceramic dielectrics comprising titania. 4th August, 1948. (636418.)

21835. Westinghouse Electric International Co.—Stabilizing circuits for electron-discharge devices. 8th August, 1947. (636357.)

22480. Allday & Co., Ltd., W., Allday, E. W., and Hancock, F. G.—Electric soldering irons 13th August, 1948. (636358.)

23484. Sangamo Weston, Ltd.—Electrical measuring instruments and relays. 25th August, 1947. (636362.)
23832. Belling & Co., Ltd., and Eastwood, M.—Electric imitation wood fires. 14th July, 1948. (636143.)
25094. General Electric Co., Ltd., and Farren, L. I.—Demodulation in pulse signalling systems. 26th August 1948. (636421.)
27231. Standard Telephones & Cables, Ltd., Jackson, R., and Bates, E. F.—Fire alarm equipment. 8th October, 1948. (636272.)
27504. Brush Development Co.—Milling of piezo-electric crystals. 14th October, 1947. (636273.)
27525. Sterling Engineering Co., Ltd., and Patchett, G. W. — Electrically driven floor-polishing machines. 14th October, 1947. (636274.)
27963. Duratube & Wire, Ltd., and Veit, J.—Manufacture of flexible strip material. 21st November, 1947. (636275.)
27997. Smit & Co.'s Transformatorenfabriek N. V. W. — Tap-changing switches for regulating electrical apparatus. 20th October, 1947. (636276.)
28514. Morgan Crucible Co., Ltd., Gow, C. C., and Harrison, J. B.—Variable resistance devices. 24th October, 1947. (636369.)
31700. British Thomson-Houston Co., Ltd.—Supercharger systems for aircraft cabins. 1st December, 1947. (636150.)
31852. Philips Electrical, Ltd.—Circuits for receiving frequency-modulated oscillations. 2nd December, 1947. (636375.)

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247. Jackson Electric Stove Co., Ltd., and Buckingham, J. W.—Electrically heated cooking ovens or the like. 4th November, 1948. (636432.)
1019. Aluminium Co. of America.—Aluminium conductor metal. 13th January, 1948. (636433.)
1628. Etablissements St. Chamond Granat.—Alternating-current synchronous electric transmission systems. 19th January, 1948. (Cognate application 1629, 29th December, 1947.) (636434.)
2001. Standard Telephones & Cables, Ltd., Mabry, R. C., Lorimer-Brown, F., and Patrick, B. W.—Remote control or indication of the angular position of a motor-driven shaft. 21st January, 1949. (636291.)
4503. Magnetic Analysis Corporation.—Electromagnetic testing. 16th February, 1948. (636441.)
5767. Guardian Electric Manufacturing Co.—Electrical plug-and-jack connector units. 26th February, 1948. (636156.)
6126. Metropolitan-Vickers Electrical Co., Ltd.—Variable area fluid nozzles. 27th February, 1948. (636296.)
6758. Westinghouse Electric International Co.—Hydrogen-cooled machines. 4th March, 1948. (636298.)
6956. Svenska Turbinfabriks Aktiebolaget Ljungstrom.—Cooling device for elastic-fluid turbines. 5th March, 1948. (636444.)
9515. Measurement, Ltd., Hewlett, S. J., and Howard, E.—Prepayment mechanism for meters. 31st January, 1949. (636160.)
31778. Sperry Corporation.—Radio location systems. 24th April, 1945. (Divided out of 636105.) (636155.)

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27671. Smit & Co.'s Transformatorenfabriek N. V., W., and Frowein, E. A.—Tap-changing switches for regulating electrical apparatus. 20th October, 1947. (Divided out of and addition to 636276.) (636312.)

Axial Flow Turbines

Developments for Industrial Requirements

MODERN industry makes use of much steam for heating and manufacturing processes as well as for the generation of electrical power. It is chiefly for installations of this kind that the Brush Electrical Engineering Co., Ltd., has developed its most recent line of geared axial-flow steam turbines. They include back-pressure and pass-out machines in a range of frame sizes as well as entirely condensing turbines for the simpler case in which there is no demand for process steam.

The nearer the process steam pressure is to the turbine inlet pressure the more important it is to prevent even the smallest reduction of the available difference by throttling. This kind of loss is avoided in the Brush turbines by admitting the steam through a series of automatically controlled nozzle valves which provide a full pressure drop at all loads, so that only below about one-quarter of the full load is steam throttled in the old way.

The nozzles are arranged in groups. The first, which contains five nozzles in most of these turbines, is permanently open and can provide enough steam to bring the turbine up to about one-quarter load by simple throttle control. Then the five nozzles of the second group begin to open up, one at a time, under the control of a series of automatic nozzle valves. The full pressure becomes available at the nozzle inlets as each of these valves is opened up by the governor gear. Further nozzles of the third group can be fully opened by hand-wheel, but the total steam inflow continues to be controlled by the automatic valves. They begin by closing automatically as the third group opens and then start to open progressively again as the load continues to increase. This process is completed by the time that about 80 per cent of the turbine's continuous maximum rating is reached. If the load still continues to increase, additional steam is directly admitted into the first stage through a by-pass valve under automatic governor control.

Commissioners' Statistics

THE last of the series of returns of Engineering and Financial Statistics formerly issued by the Electricity Commissioners has just been published by the Ministry of Fuel and Power, and is available from H.M. Stationery Office, price 30s. Most of the data contained in this publication is in tabular form, and it covers all authorized electricity supply undertakings holding statutory powers of supply at the end of the year 1947-48. It is based on information furnished by the undertakers to the Commissioners on a shortened questionnaire adopted during the war.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Bath.—15th March. City Council. Electrical work in 130 houses. City engineer, Guildhall.

Belfast.—31st March. Electricity Department. Fire resisting doors, phosphate dosing equipment and relay testing equipment. (See this issue.)

Darlington.—22nd March. Corporation. Rewiring at waterworks. (See 3rd March issue.)

Gillingham.—20th March. Corporation. Electrical stores and electric lamps for one year from 1st April next. (See this issue.)

Greece.—ATHENS.—25th April. Ministry of Posts, Telegraphs and Telephones. Telecommunications equipment and materials. (C.R.E. (I.B.) 43996/50. Ten/1037.)*

Hastings.—29th March. Corporation. Electrical installation in Primary Schools, Parker Road. (See this issue.)

Hemsworth.—18th March. R.D.C. Electrical wiring of 723 houses on various estates. S. Price, surveyor, Brierley Hall, Brierley.

India.—DELHI.—1st August. Central Waterpower, Irrigation and Navigation Commission. Transformers, switchgear, power and control cables, and other ancillary equipment for 132 kV and 66 kV sub-stations of the Hirakud Dam project. (C.R.E. (I.B.) 43575/50. Ten/1007.)*

Leeds.—3rd April. Transport Committee. Telephone cable and main feeder cable. (See this issue.)

London.—WANDSWORTH.—Corporation. Electrical contractors wishing to be placed on the Council's list for electrical installation work must apply by 22nd March. (See 3rd March issue.)

New Zealand.—WELLINGTON.—16th May, State Hydro-Electric Department. 110 kV outdoor switchgear and structure extension. (C.R.E. (I.B.) 44042/50. Ten/1026.)*

13th June. Thirteen transformer units. (C.R.E. (I.B.) 44043/50. Ten/1027.)*

Oldbury.—20th March. Borough Council. New lighting fittings and improvements in lighting installations in schools at Rood End, Titford Road, Langley, and Rounds Green, Oldbury. Borough engineer, Municipal Bank Chambers.

Peterborough.—Joint Education Board. Electrical installation for extension to Eastholm County School. (See 3rd March issue.)

Plymouth.—17th March. City Council. Electricians' sundries for one year. Stores officer, Stores Department, Mill Street.

Portslade-by-Sea.—21st March. U.D.C. Installation of electricity in 140 Council houses. (See 3rd March issue.)

Southampton.—Corporation. Street lighting relay boxes. (See this issue.)

Venezuela.—CARACAS.—24th March. Venezuelan Development Corporation. Diesel generating sets together with distribution lines for various cities. (C.R.E. (I.B.) 44580/50. Ten/1041.)*

ORDERS PLACED

Durham.—Rural District Council. Electric wash-boilers (£5 19s each).—Z Electric Lamp Co.

London.—L.C.C. Wiring and fittings for electric lighting in 345 dwellings at Downham estate, Lewisham.—London Electricity Board (Southern Sub-Area).

Middlesex.—County Council Education Committee. Installation of electric lighting at Feltham, Hanworth Road, Junior School (£943).—G. W. Franklin & Son.

Sheffield.—Corporation. Electrical installations in 326 houses on the Manor Park estate (£7,258).—Hobson & Scott, Ltd. Installations in 16 houses on the Parson Cross estate extension (£452).—Yorkshire Electricity Board. Supply and fixing of an electrode boiler and thermal water storage system at the Town Hall Chambers (£1,104).—Ratcliff (Electric), Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Houses (30) and flats (36); borough surveyor.

Bellingham (Northumberland).—Houses (28) for the R.D.C.; W. Dixon and Son, architects, 1, Collingwood Street, Newcastle-upon-Tyne.

Bilston.—Houses (64), George Street North, and flats (62), Stowlawn; McKewan Fillmore & McKewan, architects, 318, Hampstead Road, Birmingham, 20.

Birmingham.—Bank premises, Chester Road, Shard End estate; Midland Bank, Ltd., Poultry, E.C.2.

Large extensions to Council House; H. J. Manzoni, city engineer.

Bradford.—Extensions to Westwood Hospital; Leeds Regional Hospital Board, Buckworth Lane, Bradford.

Edinburgh.—Offices, Tower Place, Leith, for North of Scotland & Orkney Steam Navigation Co., Ltd.; Robert Smith & Co., Ltd., 76, Coburg Street.

Farnham.—Bakery, Guildford Road Trading estate; P. L. Thornberry & Sons, Ltd., 147, Brighton Road, South Croydon

* Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

Gateshead.—Remodelling Bensham Hospital for the Regional Hospital Board; A. Anderson, Ltd., builders, Stanmore Road, Newcastle-on-Tyne.

Glasgow.—Office block, Broomielaw; for Taggarts (Glasgow), Ltd.; Bone, Connell & Baxter, Ltd., Netherton Works, Wishaw.

Goole.—Bus station, North Street; D. C. Kean, borough surveyor, Municipal Offices.

Gosforth. — Flats, Regent Farm, for the U.D.C.; M. J. Liddell and Son, builders, 36, North Road.

Houses (418) Brunton Park; Laycock Estates, Ltd., 151, Barras Bridge, Newcastle-on-Tyne.

Jarrow-on-Tyne.—Factory additions, Bede trading estate, for British Crepemakers and Paper Products, Ltd.

Block of flats (84 dwellings), Albion Street; borough engineer.

Lancashire.—Extensions and alterations to I. M. Marsh College of Physical Education (£73,000); W. Tomkinson & Sons, Ltd., Liverpool.

London.—Shops, flats, maisonettes, etc., Stepney-Poplar reconstruction area, Neighbourhood 9 (£177,639); L.C.C., County Hall, Westminster Bridge, S.E.1.

HAMMERSMITH.—Restoration of top floor, Hammersmith Technical College for Women, for L.C.C.; director of housing, County Hall, Westminster Bridge, S.E.1.

CATFORD.—Baptist church hall, Allerford Road; P. G. Floyd, 18, Bellingham Road, S.E.6.

Lowestoft.—Houses (72), Kirkley Run, for T.C.; borough surveyor.

Maidstone.—Five blocks of flats, Hayle Road; Medway Development Co., Ltd., 53, Ewart Road, Chatham.

Maryport.—Factory extension (47,000 sq. ft.) for Bata Shoe Co., Ltd.

Morpeth.—Houses (70) for the R.D.C.; Mauchlen & Weightman, housing architects, 12, Saville Row, Newcastle-on-Tyne.

Northumberland.—Conversion of The Willows, Morpeth, into county library headquarters; county architect, County Hall, Newcastle-on-Tyne.

Northwich.—Houses (160) at various sites; surveyor, J. Birtwhistle.

Nuneaton.—Transport depot, repair shops, etc., Oaston Road, for local Co-operative Society; H. N. Jepson, architect, Midland Bank Chambers, Newdegate Place.

Ormskirk.—Houses (54) at Richmond Avenue, Burscough; J. & R. Woods (Builders), Ltd., Burscough.

Seaton Valley.—Electrical installations at 24 houses on Blyth Street estate; U.D.C. surveyor.

Sheffield.—Headquarters for R.E.M.E. at Firth Park; T. & A.F.A., St. George's Place, York.

Dental hospital, Wellesley Road; Sheffield Regional Hospital Board, Fulwood House, Old Fulwood Road.

Swansea.—Reconstruction of public baths (£22,975); borough architect.

Taunton.—Occupational therapy block, Tone Vale Hospital; Donati & Torrens, architects, 31, Bridge Street.

Tipton.—Houses (92), Roberts Field site; housing architect, Municipal Buildings.

Walsall.—Houses (80), Little Bloxwich North, in two contracts; M. E. Habershon, borough engineer, Council House.

Willesden.—Factory extensions; Mole-Richardson (England), Ltd., Chase Road, N.W.10.

Wolverhampton.—Extensions to works for Tinsley Wire Industries, Ltd., McKeand Smith & Co., Ltd., Bushbury.

TRADE MARKS

APPLICATIONS have been made for the following trade marks. Objections may be entered within a month from the dates stated:—

22nd February

CELTA. No. 678,171. Class 7. Electric dish washing, ironing, clothes wringing, knife sharpening, potato peeling and food mixing machines, and garbage disposal devices for attachment to sinks for the comminution and disposal of refuse.—Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, W.C.2.

EUTHERME. No. 678,878. Class 9. Electrical apparatus and instruments included in Class 9; scientific, measuring, signalling, checking (supervision), etc., apparatus and instruments. —Therma Fabrique d'Appareils de Chauffage Electrique Société Anonyme, Schwanden, Switzerland. Address for service: c/o Lloyd Wise, Bouly & Haig, 10, New Court, Lincoln's Inn, London, W.C.2.

REDWING and SUNBIRD. Nos. 683,873-4 respectively. Class 9. Electric polishing and cleaning machines, all for domestic use.—AMI (Great Britain), Ltd., 27, Whitcomb Street, London, W.C.2.

STYLITE. No. 681,566. Class 11. Lighting fittings, ornamental lamps, for buildings, light reflectors, spotlights and floodlights.—London Industrial Art, Ltd., 33, Jubilee Place, S.W.3.

PLASTICLAS. No. B682,433. Class 11. Electric light fittings of plastics.—B.G. (London), Ltd., 17, Stratford Place, London, W.1.

1st March

DELANIUM. No. 684,432. Class 7. Dynamo brushes made of carbon; and tubes made of carbon, being parts of industrial chemical machinery.—Powell Duffryn Carbon Products, Ltd., Springfield Road, Hayes, Middx.

STELLEX. No. 679,380. Class 9. Indicating devices for use in the control of heat; and testing instruments, electric terminals, batteries, electric bells, buzzers, coils, control apparatus included in Class 9, electric distribution boards, distribution boxes, flat irons, induction apparatus, cooking utensils included in Class 9, electric soldering irons and resistances.—C. H. Blackburn & Co., Ltd., 10, Gray's Inn Road, W.C.1.

WAYGOOD-OTIS (design). No. 681,962. Class 9. Electrically operated door openers and closers; electric switchgear for use in connection with lifts, hoists and moving stairways; and visual and audible electric signalling aparatus for use in connection with lifts and hoists.—Waygood-Otis, Ltd., Falmouth Road, London, S.E.1.

SPIROTO. No. 682,615. Class 9. Electric transformers and chokes.—Brentford Transformers, Ltd., Breco Works, Kidbrooke Park Road, Kidbrooke, London, S.E.3.